MAY, 1944 VOL. 33, No. 5

Periodical

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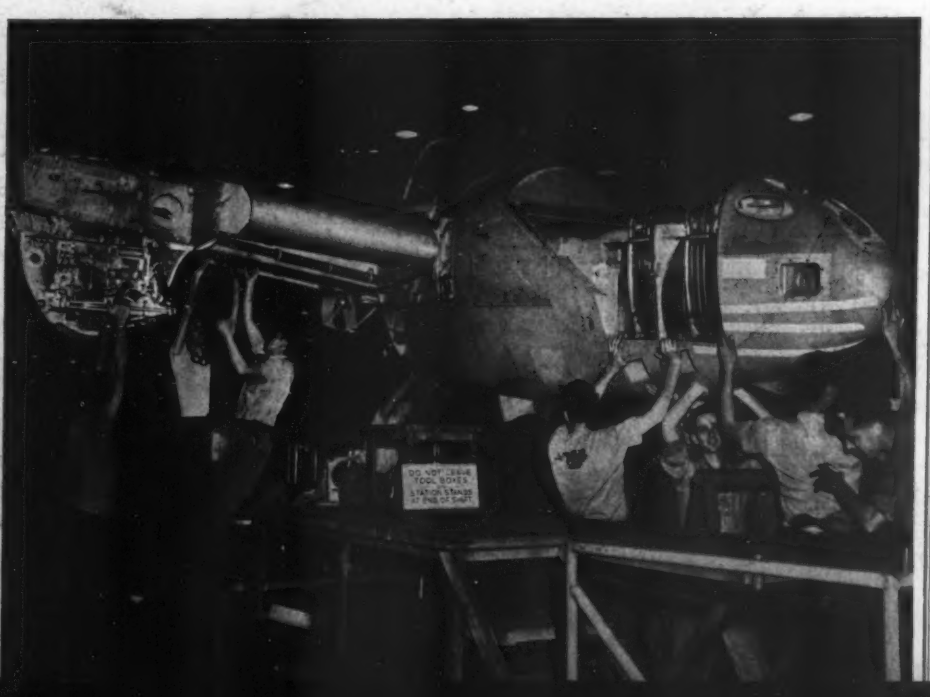
INDUSTRIAL ARTS AND VOCATIONAL EDUCATION

THE SHOP TEACHERS' PROFESSIONAL MAGAZINE

REQUISITION NUMBER



This culture dish contains colonies of the dread staphylococcus, and a commonplace substance like bread mold. The mold gives off penicillin *that is robbing killer diseases of their terrors.*

BIRTH OF A MIRACLE

Photo courtesy: E. R. Squibb & Sons

• Penicillin, the wonder drug that promises to overshadow the sulpha family, is more than a product of man's infinite genius. It is another in the endless list of achievements that testify to the astounding possibilities that reside in the commonplace. But more than this, it is further evidence that these miracles await only the vision that can discover them and the comprehension that can put them to work for the betterment of all mankind.

The miracles that reside in the commonplace . . . this is something that intelligent educators have always known. *They* know that from the common or schoolroom variety of boys come the leaders in engineering, famous scientists, captains of industry and great artists. *They* know that boys differ little in their innate potentialities. *Their* concern has been to discover and put to work the influences that can lift a boy out of the commonplace, raise his standards, give him a glimpse of the possibilities ahead, and above all fan into flame the spark of ambition that resides in every human breast. That is why conscientious instructors in mechanical drafting insist that the drafting instruments their pupils use shall be carefully chosen. A fine set of instruments gives pride of possession, lends wings to the imagination of the boy who is its possessor. Its unstinted quality reinforces a boy's belief in himself, his interest in his work, his ambition to excel in a study that leads so directly into the activities of adult life. The opportunity that here exists is too tremendous to be risked on the false economy of inferior equipment.

EUGENE DIETZGEN CO.

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Pittsburgh • Los Angeles • Philadelphia
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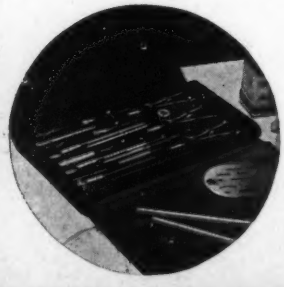
Dealers in All Principal Cities



Army-Navy "E" Production Award for Excellence in Manufacturing, Drafting and Surveying Instruments and Supplies for the Armed Services of the United States.

ARMY E NAVY

DIETZGEN

EVERYTHING FOR DRAFTING AND SURVEYING

MAY,

War Production Lathes

ARE BEST FOR TEACHING WAR PRODUCTION SKILLS

SOUTH BEND
14½" TOOLROOM LATHE

TEACHING HELPS

South Bend teaching helps—books, sound films, wall charts, and bulletins on the care and operation of a lathe—are available for school shop instruction. Write for Circular No. 21-C.

Preparing men and women for war plant work is serious business. The cancellation of thousands of occupational deferments has resulted in such a critical shortage of skilled workers that there is little time for retraining on the job. The need for sound, practical training on full-sized industrial machines was never greater than now.

Matching your shop equipment with that used in industry will enable your students to take their places in war plants with a minimum loss of time. Because South Bend Lathes are so widely used by the war production industries, the Army, and the Navy, they are especially practical for pre-employment and pre-induction training.

BUY WAR BONDS... SAVE FOR LATHES

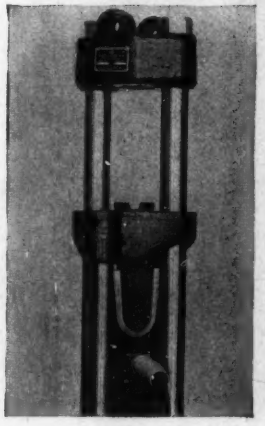
SOUTH BEND LATHE WORKS

LATHE BUILDERS FOR 37 YEARS • SOUTH BEND 22, INDIANA

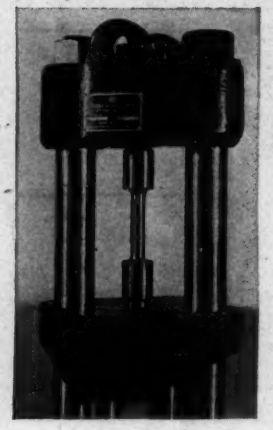
Indispensable for the modern welding school

THE NEW PORTABLE AIRCO TENSILE AND GUIDED BEND TESTING MACHINE

Making the Transverse Tension Test.



Making the Guided Bend Test using anvil and die supplied with the machine.



Longitudinal all-weld metal (0.505") test specimen being tested, using special jaws.

HERE'S a compact, accurate weld-testing machine that every modern school will welcome. Sturdily constructed, it provides a convenient means of obtaining accurate test data for qualifying student welders.

With this improved Airco machine three important tests can be made on standard test specimens — 1. Reduced section transverse tension tests; 2. Guided bend tests (a complete 180° face or root bend); 3. Longitudinal all-weld metal 0.505" tension tests. This is *the only portable testing machine available that combines all three functions in convenient, portable form.*

The machine operates on the principle of the hydraulic jack. Maximum direct load is 40,000 pounds, permitting tests on material of 150,000 psi. or higher tensile strength, by selecting the proper area for the test piece. A maximum hand mounted on the face of the gauge indicates the breaking load applied to the specimen.

The machine is packed in a strong oak carrying case with handles. Equipment includes the die and anvil for the guided bend test and jaws for the transverse tension test. Jaws for the longitudinal all-weld metal 0.505" test coupon are not furnished as standard equipment but are supplied on special order.

For complete data, mail the coupon below.

OTHER AIRCO PRODUCTS FOR WELDING SCHOOLS

- Oxygen, acetylene, and other gases
- Welding and cutting torches and tips
- Arc welding machines both AC and DC types
- Regulators, welding rods and a complete line of supplies
- Arc welding electrodes
- Arc welding accessories: helmets, holders, cable, etc.

BUY UNITED STATES WAR BONDS

Air Reduction IAV
60 East 42nd St.
New York 17, N. Y.

Please send me a free copy of booklet Form ADI-889, describing the Airco Tensile and Guided Bend Testing Machine.

Name_____

School_____

Address_____

City_____ State_____

AIRCO WILSON

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General Offices: 60 EAST 42nd STREET, NEW YORK 17, N. Y.
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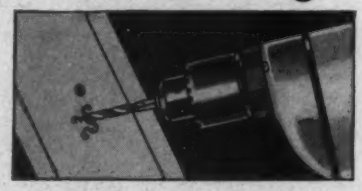
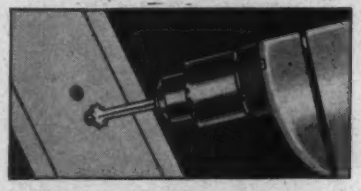
The Top-Speed Two Gun Team

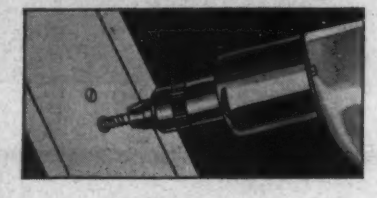
for Drilling



Countersinking



Screwdriving



BLACK & DECKER'S Holgun and Scrugun—that's industry's top-choice team for countless assembly operations in wood, metal, plastics and other materials. So that's the team for training! Holguns for drilling and countersinking . . . Scruguns for driving wood screws, self-tapping screws, machine screws and nuts. Each is a light, compact "Handful of Power" . . . with the famous Pistol Grip and Trigger Switch.

Industrial schools and shops standardize on Black & Decker Portable Electric Tools because they are so widely used, throughout every branch of American industry. So it's best to have students *learn* now on the same tools with which they'll *earn* later. Your nearby Black & Decker Distributor will be glad to help you choose the right tools for your training program.

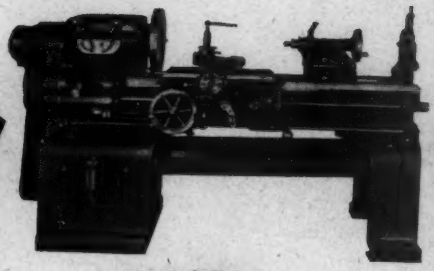
LESSONS IN INGENUITY—FREE

If you haven't received our booklet—"They Used Their Heads"—write for a free copy. It shows how ingenious production men have combined brains with Black & Decker Tools to solve difficult production problems. Teachers will find it especially helpful and informative. Address: The Black & Decker Mfg. Co., 780 Pennsylvania Ave., Towson 4, Maryland.

LEADING DISTRIBUTORS EVERYWHERE SELL

Black & Decker

PORTABLE ELECTRIC TOOLS



STAR OF THE SHOW!

Popularity's peak goes with the trade-wise phrase . . . the "Best Lathe In The Medium Price Field".

Train your students on the popular lathe they'll use when they graduate into business . . . the precision lathe made by the precision artisans.

SEBASTIAN LATHES

Manufactured by STOKES INDUSTRIES Cincinnati, Ohio

NEW YORK CITY
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Tel.: BARCLAY 7-3318

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Tel.: DISTRICT 5382

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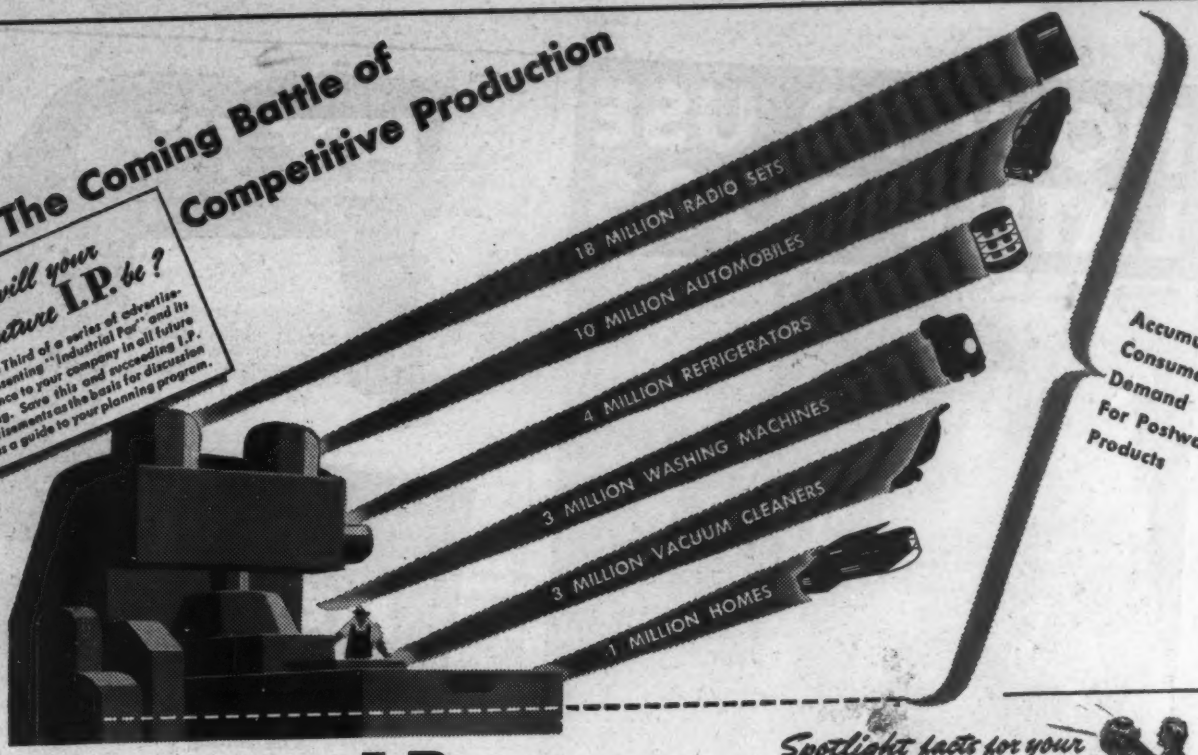
CHICAGO, ILLINOIS
541 WEST WASHINGTON BLVD.
Tel.: STATE 3092

INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, May, 1944, Volume 33, No. 5. Published monthly, except during July and August, by The Bruce Publishing Co., Milwaukee 1, Wis. Entered January 2, 1914, as Second-Class Matter at Milwaukee 1, Wis., under Act of March 3, 1879. Subscriptions — U. S., $2.50 per year. Canada and Foreign, $3.00. Single copies, 35 cents.

The Coming Battle of Competitive Production

What will your future I.P. be?

†† This is the Third of a series of advertisements presenting "Industrial Par" and its importance to your company in all future planning. Save this and succeeding I.P. advertisements as the basis for discussion and as a guide to your planning program.



will your company's I.P. qualify you to meet the Challenge

THERE'S a lot of "wants" waiting to be supplied by peacetime production. Millions of people are just marking time—with billions in money saved and ready to spend — to buy new radios, cars, refrigerators, washing machines, vacuum cleaners, homes and scores of other products as soon as they become available again. When this flood of pent-up purchasing power breaks, American industry can expect a hard battle of competitive production. The old rule of three in manufacturing consumer goods—quality, quantity, low cost — will be in full sway again.

Manufacturing for peacetime markets will challenge managerial skill as much as manufacturing for war. Building a dominant position in these markets — finding profits — establishing the conditions for employment — will call for broad-visioned plans, able direction and execution.

To improve quality — reduce cost — and increase the output of goods, machine tools — the newest and finest — are indispensable. Machine tools are of key importance in determining your company's standing in terms of *industrial par* — the constantly increasing output per man-hour equal to approximately 50% every 10 years.

Other things being equal — quality of product, price, sales organization — the successes in the coming battle of competitive production will come to those companies best qualified to attain or excel industrial par — its vital significance as summarized in the panel headed "Spotlight Facts for Your Future I. P. Planning."

Your planning for postwar should include as a major project the matter of machine tools — provision for their continuing replacement to assure full productive capacity — to enable you to keep step with a high level of national prosperity — the volume production of more goods for more people at lowest cost and the resulting security of jobs and wages for the greatest number of workers.

Let's all back the attack! **BUY MORE BONDS**

Spotlight facts for your future I.P. *planning*

* Production methods — developed in wartime —increase man-hour output; pent-up buying power — released in peacetime — demands increased production.
* The rate of 2½% increase per year output per man-hour, established by a 12 year record of industrial production, can be expected to reach at least 4% per year — compounded.
* Manufacturers must set a goal of 50% increased output per man-hour every 10 years — to maintain a high level of national prosperity and achieve its benefits in terms of security of jobs and wages for the greatest number of workers and the volume production of more goods for more people at lowest cost.
* Machine tools — the most modern, most efficient — are recognized as the most effective implements of mass production and increased output at lowest cost — but only continual replacements with the newest and finest machine tools assures full productive capacity. *Such replacements yearly should be equal to 10% of the total machine tool investment — in keeping with increased output.*
* The cost of machine tools is insignificant in terms of their productive power . . . from 1927 to 1937, according to census reports, American manufacturers had only a total of about 2% invested yearly in machine tools in ratio to a total volume of 9 billion dollars' worth of production annually.

†† **Industrial Par** — *the constantly increasing output per man-hour equal to approximately 50% every 10 years.*

KEARNEY & TRECKER CORPORATION

MILWAUKEE 14 WISCONSIN

Milwaukee Machine Tools

THE advertisement above is reproduced from our current advertising campaign appearing in the business and industrial press. We believe these advertisements should be of interest and value to the young men who are being trained for tomorrow's industry, in terms of the trend and importance of machine tools to the industrial world of the future. May we suggest that you clip this advertisement and post it in your classroom or bulletin board so that it is brought to the attention of your students.

HOW TO USE LATHE DOGS

Ask for FREE Data Sheet No. 23

Many turning operations involve the use of Lathe Dogs. Data Sheet No. 23 describes and illustrates the various standard dog types, tells which one to use for a given job, and explains proper application to various types of between centers work.

Instructors and students will find this and other Williams' Data Sheets very helpful. The various subjects covered are listed below.

1. Data on "Superior" Wrenches.
2. Data on Boring Tools.
3. Data on Chain Pipe Tongs.
4. Data on "Supersocket" Wrenches.
5. Data on Lathe Dogs.
6. Data on Chain Pipe Vises.
7. Data on Turning Tools.
8. Types of "Superior" Wrenches.
9. Use of "Supersocket" Wrenches.
10. Data on Eye Bolts.
11. Data on "C" Clamps.
12. Use of Cutting-Off Tools.
13. Use of Knurling Tools.
14. External Thread Cutting.
15. Internal Thread Cutting.
16 to 21. Six Data Sheets on grinding cutters for Tool Holders.
22. Use of Open-end Wrenches.
23. Use of Lathe Dogs.

MAIL THIS COUPON

J. H. Williams & Co., Dept. I-544, Buffalo 7, N. Y.
Please send Data Sheets circled below:

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16—21 22 23

Name _____

Address _____

City _____ *State* _____

WILLIAMS
SUPERIOR DROP-FORGED TOOLS

RACINE "Utility" Model Dry Cut Metal Saw Capacity 6" x 6"

LOW COST METAL SAW

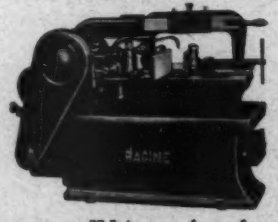
For modern vocational training

Yesterday's metal cutting methods have little value in the fast training of students today — for the high speed production lines of tomorrow.

A Racine "Utility" machine, the same saw used in industry, is the ideal equipment for all your metal cutting work — from soft aluminum tubing to tough alloy steel. Simple hydraulic operating controls and maximum safety features make it easy for anyone to operate. Capacity is 6" x 6".

OIL HYDRAULIC FEED AND PRESSURE CONTROL

A simple graduated dial controls the feeding pressure on the saw blade — materially reducing blade breakage — a small needle valve controls the rate of feed.



Utility
WET CUT MODEL

Same as Dry Cut Model above except the enclosed base is equipped with coolant pump. Write today for complete information. Address Dept. IA-S.

RACINE TOOL AND MACHINE COMPANY
Standard for Quality and Precision
RACINE, WISCONSIN, U. S. A.

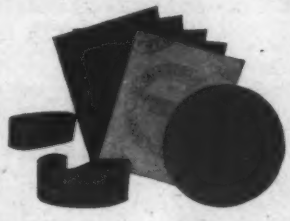
Train Students faster and better with Carborundum's 2 point teaching program!

1– TEACH STUDENTS WITH THE TOOLS THEY'LL USE ON THE JOB!

GRINDING WHEELS. In industry wheels by Carborundum play a more important part than ever before. In the class they are used for grinding lathe and woodworking tools, chisels, reamers, cutters, hobs, drills, etc. Their use will enable your classes to do faster and better work.

METAL FINISHING CLOTH. In modern machine shops an endless number of jobs are being done with Aloxite Brand Coated Abrasives. Indispensable for metal finishing, removing rust, fitting metal parts, cleaning up for brazing.

COMBINATION SHARPENING STONES BY CARBORUNDUM. In industry as in class, sharp tools do better work and last longer. So proper tool sharpening is one of the most important things your students learn. These stones have a coarse side to bring the tool to an edge, a fine side to give a keen, smooth cutting edge.



COATED ABRASIVES FOR WOODWORKING. No use teaching "the hard way." Hundreds of woodworking plants have discovered that coated abrasives by Carborundum produce smooth, cleanly sanded finishes quicker—easier. Try Carborundum Brand Garnet Paper, in sheets, belts or discs.

2– USE CARBORUNDUM'S FREE INSTRUCTION MATERIAL!

1. BOUND VOLUMES. A limited number of bound Grinding Bulletins are available for instructors as well as for placement in your classroom or technical library for reference purposes.

2. GRINDING BULLETINS. A set of 25 four-page bulletins for each student, offering a concise, non-technical discussion of grinding wheels and their functions. Sample of the contents: "The Abrasive Tools of Industry," "Wheel Stresses," "Wheel Balancing," "Cylindrical Grinding," "Grinding Errors," "Safety."

Educational Service Department
The Carborundum Company, Niagara Falls, N. Y.

We would appreciate your sending us added information on the Carborundum Training Program.

Name.....

Address.....

School.....

Courses taught (or title).....

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Abrasive Products by CARBORUNDUM

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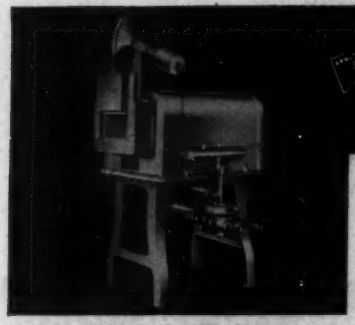
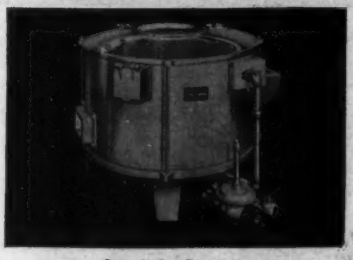
STEWART

THE BEST INDUSTRIAL FURNACES MADE

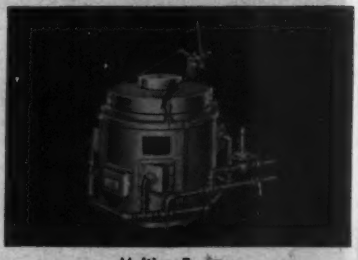


Small Semi-Muffle Oven

Small Forge



Round Pot Furnace



Melting Furnace

HUNDREDS OF THESE STEWART FURNACES ARE IN THE VOCATIONAL DEPARTMENTS OF TECHNICAL SCHOOLS

Because Stewart units have been designed for efficient production heat treating in small shops and tool rooms, they are widely recognized as standard equipment for all types of industrial heat treating and vocational training work. For student instruction and reference with further details on Stewart Furnaces especially suitable for school shop use, write for our free "STEWART HANDBOOK of Heat Treating Information and Equipment." Also the new Stewart DATA FILE on school units.

STEWART INDUSTRIAL FURNACE DIV. of CHICAGO FLEXIBLE SHAFT CO.

Main Office: 5600 W. Roosevelt Rd., Dept. 129, Chicago 50, Ill.
New York Office: 11 West 42nd St., New York 18, N. Y.

Bench Oven Furnace | Triple Purpose Combination "E" | Triple Purpose Combination "D" | Dual Combination

LUFKIN STEEL RULES

• TEMPERED STEEL •

MOST SATISFACTORY RULES FOR SCHOOL SHOP USE

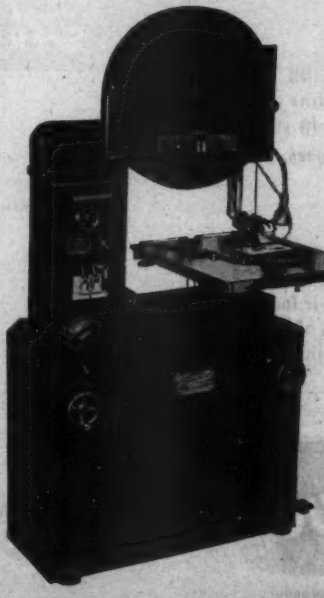
LUFKIN

PRECISION TOOLS • TAPES • RULES

SAGINAW, MICHIGAN NEW YORK CITY

Tannewitz DI-SAWS

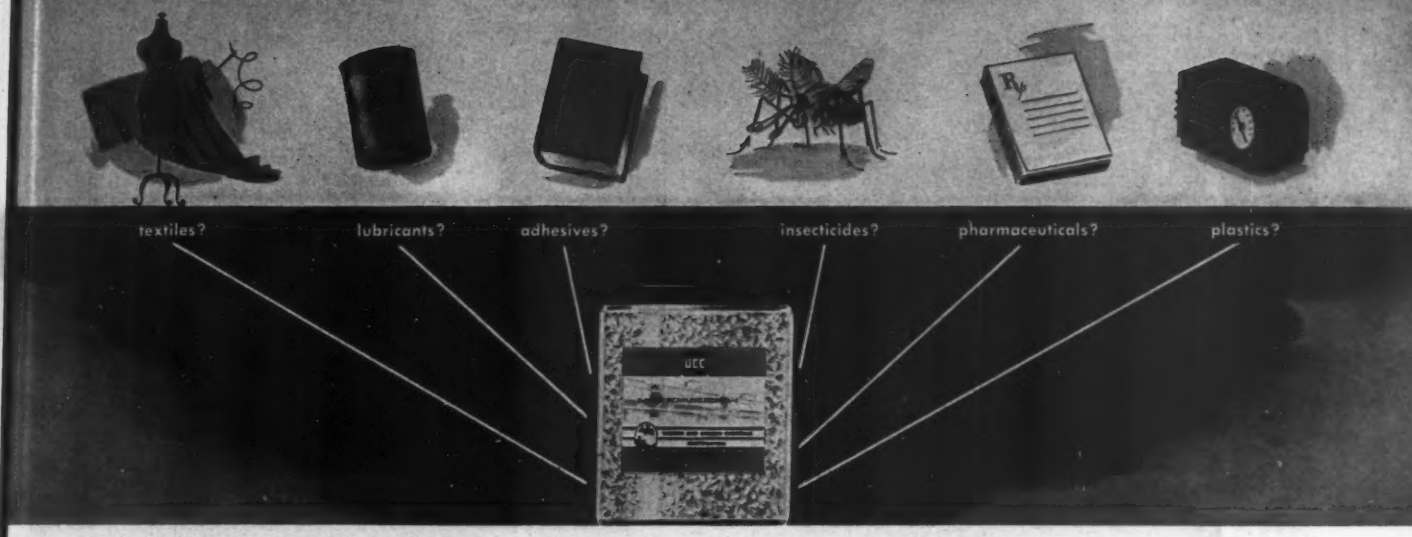
Most Essential Requirement for Your Machine Shop!



With this extremely versatile machine, tools and dies, machine parts or other items of practically any shape may be made in the minimum of time from steel or any other material; for it provides for inside and outside sawing, using blades 3/32" to ½" wide, chain filing — in three different file widths, and endless belt polishing. Because of this great versatility as well as the fact that these machines are being widely used in machine shops throughout the country where they are obsoleting other methods, a TANNEWITZ DI-SAW should be the number one item to be purchased for your school shop. Complete details furnished on request. Just ask for DI-SAW Bulletin.

THE TANNEWITZ WORKS, GRAND RAPIDS, MICH.

What would you do with some 3,3,5-trimethylcyclohexanol-1?



EVEN *we* know only a little of what you might do with it... yet. Trimethylcyclohexanol (you pronounce it try'-meth'-il-sy'-klo-hex'-an-ohl) is a new industrial chemical by CARBIDE AND CARBON CHEMICALS CORPORATION... made with atoms obtained from common substances, rearranged into molecules that are not known to exist in nature.

What's this new synthetic organic chemical good for? No one yet knows all of the useful things it might be made to do. If you are technically minded you'll find some of the facts so far discovered in the italicized paragraph at the right. Whatever your interest, you will be glad to know that this new chemical has potential uses in the making of such things as medicines, plastics, lubricating oils, and adhesives.

In their service to industry as incubators for raw materials, the laboratories of this Unit of UCC are continually developing such new chemicals. An almost predictable percentage of them prove to be extremely valuable. Out of hundreds already developed have come scores from which scientists in industry have developed useful products of many kinds.

Some of the chemicals are used to make superior anti-freezes. Others are raw materials for quantity production of vitamins and life-saving drugs. Still others make possible improved cosmetics, plastics, textiles, photofilm, insect repellents, anesthetics... and hundreds of things of benefit to you in your daily life.

Through continuing research which is developing new materials out of common substances, CARBIDE AND CARBON CHEMICALS CORPORATION is helping to make many things more plentiful or more useful. And the research of this one Unit... in that field which often must appear to the layman as "unknown chemicals"... gives you an idea of what the combined research of all UCC Units in many basic fields means to you.

▼

Model of Molecule of Trimethylcyclohexanol

As Trimethylcyclohexanol is one of the newest additions to this family of synthetic organic chemicals, its story is still incomplete. It is an alcohol with a high boiling point (388° Fahrenheit). At room temperature, it is a white solid with an odor like menthol. It dissolves in other alcohols, gasoline, benzene, ethers, and vegetable oils like linseed oil, but does not dissolve in water. It can be supplied in carload quantities if and when the need arises.

Technically minded men and women can obtain information on the properties and uses of more than 160 other products of Carbide and Carbon Chemicals Corporation by writing for Booklet K-5, "Synthetic Organic Chemicals."

BUY UNITED STATES WAR BONDS AND STAMPS

UNION CARBIDE AND CARBON CORPORATION

30 East 42nd Street UCC New York 17, N. Y.

Principal Units in the United States and their Products

ALLOYS AND METALS
Electro Metallurgical Company
Haynes Stellite Company
United States Vanadium Corporation

CHEMICALS
Carbide and Carbon Chemicals Corporation

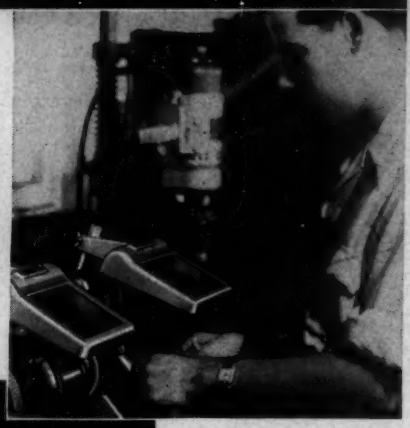
ELECTRODES, CARBONS AND BATTERIES
National Carbon Company, Inc.

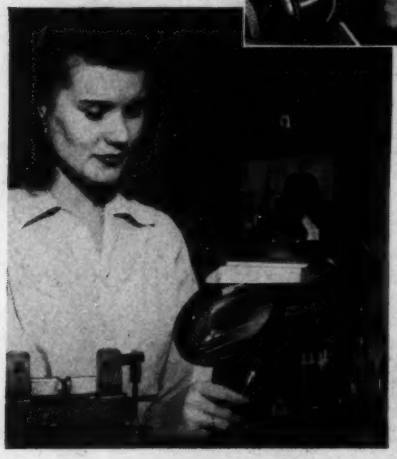
INDUSTRIAL GASES AND CARBIDE
The Linde Air Products Company
The Oxweld Railroad Service Company
The Prest-O-Lite Company, Inc.

PLASTICS
Bakelite Corporation
Plastics Division of Carbide and Carbon Chemicals Corporation

To Practice What You Teach

Stanley "Flud-Lite" Eye Shields easily applied to bench or belt-driven grinders.





Stanley "Flud-Lite" Magnifiers available in bench and portable hand grip models.

STANLEY

"Flud-Lite" Eye Shields

The Importance of Eye Protection is demonstrated efficiently when your school shop grinders are equipped with Stanley "Flud-Lite" Eye Shields. The combination of safety glass and ample light on the work helps prevent injuries, improves work, saves tools. The Eye Shields are adjustable, but cannot be moved to non-guarding position.

"Flud-Lite" Magnifiers

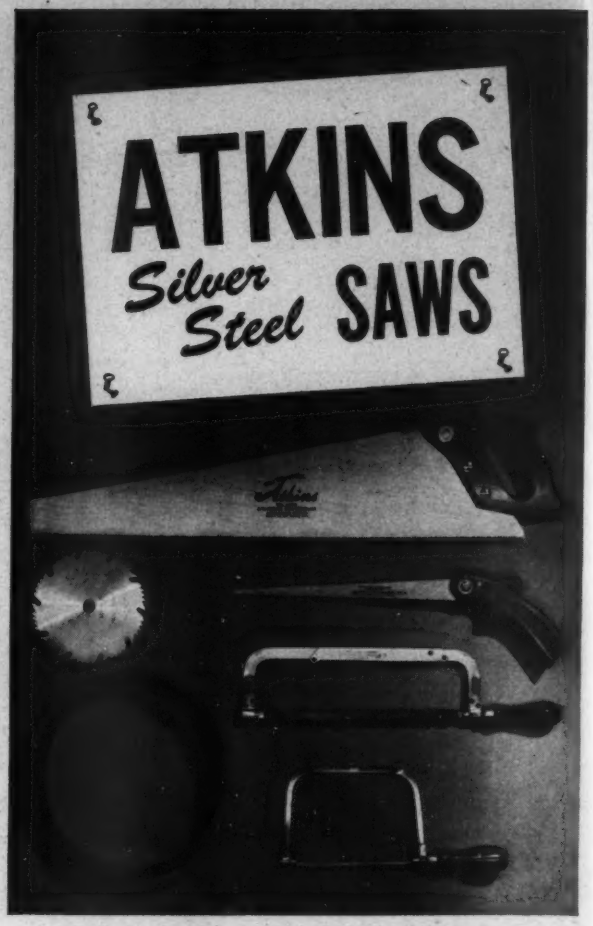
The Importance of Eye Efficiency is proved in a practical way through the use of Stanley "Flud-Lite" Magnifiers in the shop and other school departments—such as printing shop, physical and biological laboratory. The high quality 5" lens and fluorescent daylight lamp is a decided aid in examining machined parts for flaws, and for many other magnifying purposes.

Write for details. Educational Dept., Stanley Electric Tool Division, The Stanley Works, New Britain, Connecticut.

STANLEY

TRADE MARK

STANLEY ELECTRIC TOOLS



It's Easier to Learn
THE RIGHT WAY
with
THE RIGHT SAW

While every manual training room is likely to have saws of the right type for every kind of work, it's a good habit to make periodic checks of saws. Successful training, of course, depends a great deal on the student's access not only to right *type* of saw, but to *good* saws, whatever the type. In addition to those shown, the Atkins Silver Steel line includes numerous other types. Check over your saws now—and replace the inefficient ones with correctly designed, edge-holding Atkins Saws. Write for the Atkins Catalog of School Saws.

***Free*—Wall Chart on Saw Fitting**

A valuable aid to teaching saw maintenance. A 19" x 25" wall chart that illustrates in detail the right way of filing and setting saw teeth. Free copy on request.

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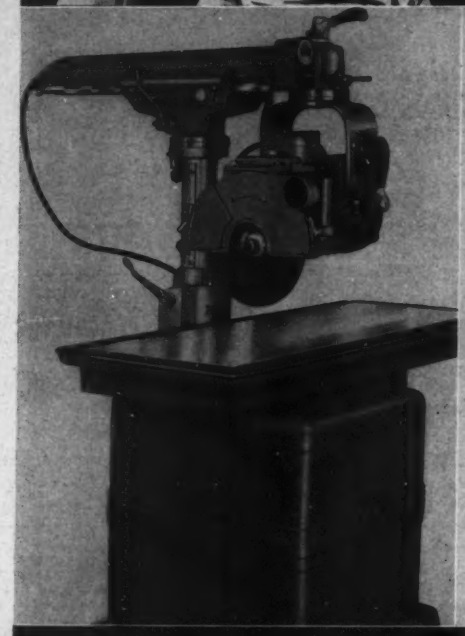
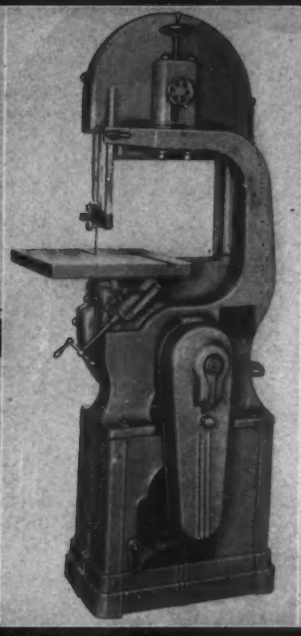
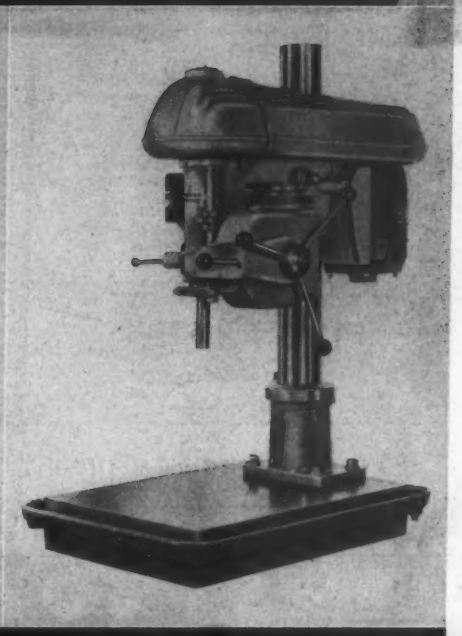


METAL-CUTTING RADIAL MACHINES — Transverse travel of 21½" enables operator to cut wide material and various shapes. Patented geared motor makes possible use of small diameter wheels.



BAND SAWS—14" and 16" models. Back gearing and cone pulley provide speed range from 61 to 5300 s.f.m. for cutting practically any material from tool steel to wood.



20 INCH DRILL PRESSES—Hand or power feed, in bench, floor and multiple spindle models. Spindle speeds 260-5200 r.p.m. Capacity 1" in cast iron, ¾" in steel.

CHECK vocational schools using Walker-Turner Machine Tools and you'll find that their popularity is a three-way proposition.

Students like the safe, simplified design which makes for easy, accident-free operation. *Instructors* favor the wide range of cutting speeds and great flexibility which fit them for a variety of projects — the ruggedness that is so necessary with "green operators" — the simplicity which enables students to concentrate on the project rather than the machine. And the men who plan school *budgets* root for them because Walker-Turner Machine Tools give thorough industrial training at prices kept low through thoughtful design, careful selection of materials, and assembly line production methods.

Proven on thousands of machining applications in Industry, Walker-Turner Machine Tools are promptly available for war production training. Write today for our latest catalog.

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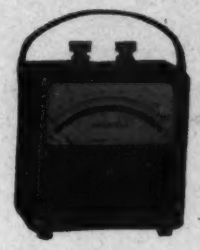

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Ideally suited for classroom instruction and student use because of their dependability, ruggedness and relatively low cost . . . features which have made the Model 430 line so universally preferred throughout industry. Have hand-calibrated mirror scales of long length, with large scale openings. Accuracy within ½ of 1%. Sturdy Bakelite cases give added protection in service. Extremely compact. Available in complete line of A-C and D-C instruments.

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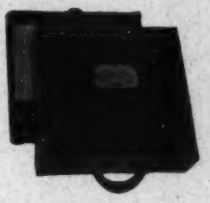

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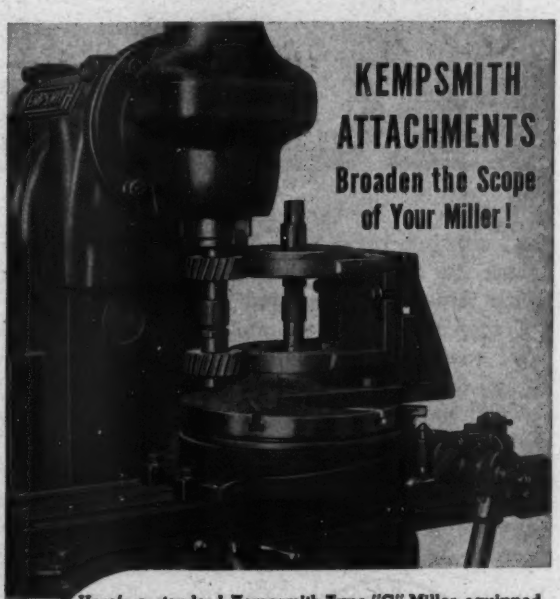

Here's a standard Kempsmith Type "G" Miller equipped with Vertical Head and Rotary Table for milling Dividing Head Frames. Note the deep, smooth cuts taken on the incomplete circle. Just another example of Kempsmith ruggedness and adaptability.

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KEMPSMITH

PRECISION MILLING MACHINES SINCE 1888

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AND PRECISION, PRELOADED BALL BEARING HEADSTOCK

*Arrows indicate location and number of self-lubricating bearings in Logan Quick Change Gear Lathe. All Logan Lathes are similarly protected.

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Brief Specifications: **. . . Swing over bed, 10½" . . . Between centers, 24" . . . Bed length, 43⅛" . . . Spindle hole, 25/32" . . . Precision ground ways: 2 prismatic V-ways; 2 flat ways . . . 12 spindle speeds, 30 to 1450 r.p.m.**

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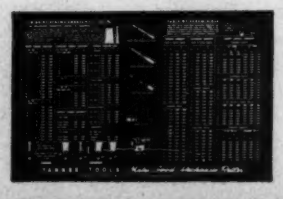
As industry rewards employees who suggest ideas that speed production, so do "Yankee" Fine Mechanics' Tools reward the teachers of future craftsmen by showing those students how to save time and energy on future jobs. From Spiral Screw Drivers to Tap Wrenches and from Automatic Drills to Bit Braces, each "Yankee" Tool has been painstakingly *designed* to get things done. Ingenious and dependable, "Yankee" Tools have contributed to the efficiency of American production *and* American teaching for nearly half a century. Today, of course, they've gone to war . . . and the demands of war, quite naturally, have first call.

FREE! Write for a copy of the handy "Yankee" Reference Chart, featuring relative tables of screw-driver blade and screw sizes, and giving graphic instructions on how to drive screws correctly.



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make good mechanics better

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Established 1880

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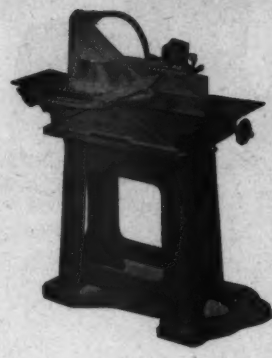

No. 10 JOINTER

Direct drive at 3600 or gear drive at 5200 r.p.m.! 8" *four*-knived cutter-head with knives set askew for *shearing* cut! Taper roller bearings. Semi-steel tables. Capacity to cut ¾" deep.

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Skew-set knives take a shearing cut—does *perfect* edging work, rabbetting, bevelling. Smooth, clean surfacing cuts seldom require sanding.

Write today for bulletins, — we also manufacture high-grade Universal Saws, Radial-arm Saws, Bandsaws, Shapers, Lathes, Mortisers, Oilstone Grinders, etc.

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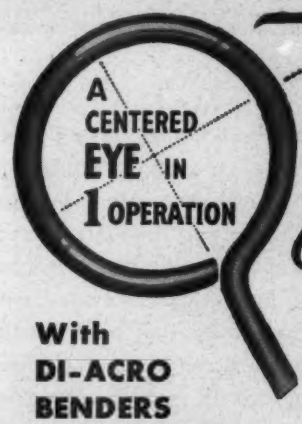

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DI-ACRO Precision Bending is accurate to .001" for duplicated parts. DI-ACRO Benders bend angle, channel, rod, tubing, wire, moulding, strip stock, etc. Machines are easily adjustable for simple, compound and reverse bends of varying radii.

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With new materials and advanced techniques such an important part of the postwar picture, it's essential that today's students — tomorrow's craftsmen — work today with the tools they'll use when they graduate. Many new vocational schools, city, state and national, are scheduled to open or are being planned. Don't let your school lag behind them in tools or methods. Give your students the benefits of working with the machines that are being enthusiastically adopted by progressive shopmen and industrialists everywhere—PORTER-CABLE.

TAKE-ABOUT The Dustless Sander

The world's most popular sander. Perfect balance — instant belt change — dust-free operation — silent chain drive — an extra powerful motor — all help achieve faster, easier, finer sanding. Give them the machine that gives their work a craftsman's finish.

Porter-Cable AG8 Wet-Dry Belt Surfacer

With Wet-Belt Surfacing solid areas, flanges, bosses, interrupted sections, can be surfaced with one application to the belt — freehand or with simple jigs — eliminating the distortion that often results from clamping. Effective coolants do away with frictional heat, distortion, cracking, discoloring, flow. Wet-Belt Surfacing is faster — 5 to 25 times faster — than previous methods. It works equally well on hard and soft metals, plastics, wood, fibre, rubber, ceramics, glass. It is ideally suited to aluminum and magnesium alloys — even thin sections can be machined without distortion.

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Designed for irregular or curved work, its flexible abrasive belt, wet or dry, follows the contours and produces an even, uniform finish. Adjustable backing plate for flat or uniformly curved surfaces.

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With adjustable position (either horizontal or vertical), this model is recommended for finishing small parts. Many light milling and grinding operations done without fixtures. Popular for second operation work. Used in many toolrooms. Slotted table adjustable up to 45°, for machining angled surfaces.

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Rips, cuts, miters, perfectly. Equipped with the most advanced safety appliances. Compact. Ball Bearing throughout.

This No 232 saw bench is but one of a high grade line of woodworking machinery. The complete line includes lathes jointers, sanders, shapers, planers, band saws, vises, etc.

Write today for complete illustrated circulars on the above or any other machine you are interested in.

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WITH EASY-TO-USE

SKILSAW SANDERS!

ZEPHYRPLANE—the modern, streamlined belt sander with 3-in. belt. Ideal for all sanding and final-finishing. Powerful, ruggedly built to provide long, trouble-free operation. Light, compact, easy to handle.

• Manual training students take more interest in their work when you put a SKILSAW Sander in their hands. That's the fastest way to teach them *good* surfacing. That's the easiest way to sand and clean, to line up glued joints, to refinish any surface in school project work.

SKILSAW SANDERS are lighter for easiest handling . . . more powerful for faster work on every job. They are better balanced for uniform pressure over the whole sanding surface . . . leave no ripples or ridges. SKILSAW Sanders are available in 4 models, with 2¼ in., 3 in., and 4½ in. belt widths. Ask your distributor for a demonstration at your school.

Send for This Free New Catalog
Shows the complete line of SKILSAW TOOLS, contains handy Maintenance and Operation Manual. Full of valuable information to help you do a better job of teaching students how to use and care for portable electric tools.

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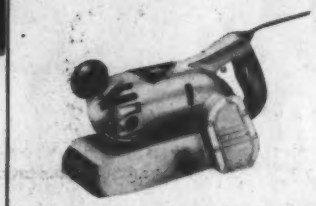

ZEPHYRPLANE, JR. 2¼-in. Belt . . . Outstanding lightweight belt sander for intermittent use in woodworking and cabinet making. Weighs only 9½ lbs.

MODEL "A"—with 4½-in. Belt... A fast, powerful belt sander for toughest sanding and surfacing jobs. Also MODEL "B"—same size with vacuum dust collector.

CAN YOU NAME 'EM?

FILE QUIZ

—for mechanical-training students. Compiled from information contained in *"File Filosophy,"* the 48-page Nicholson book on the history, manufacture, kinds, use and care of files. Copies of this authoritative and widely recognized book should be in every school library and in the hands of every industrial arts instructor.

FREE TO SCHOOL MANAGEMENTS. *How many copies do you need?* Also—

FREE REPRINTS OF THIS PAGE— if you want them for classroom "quiz."

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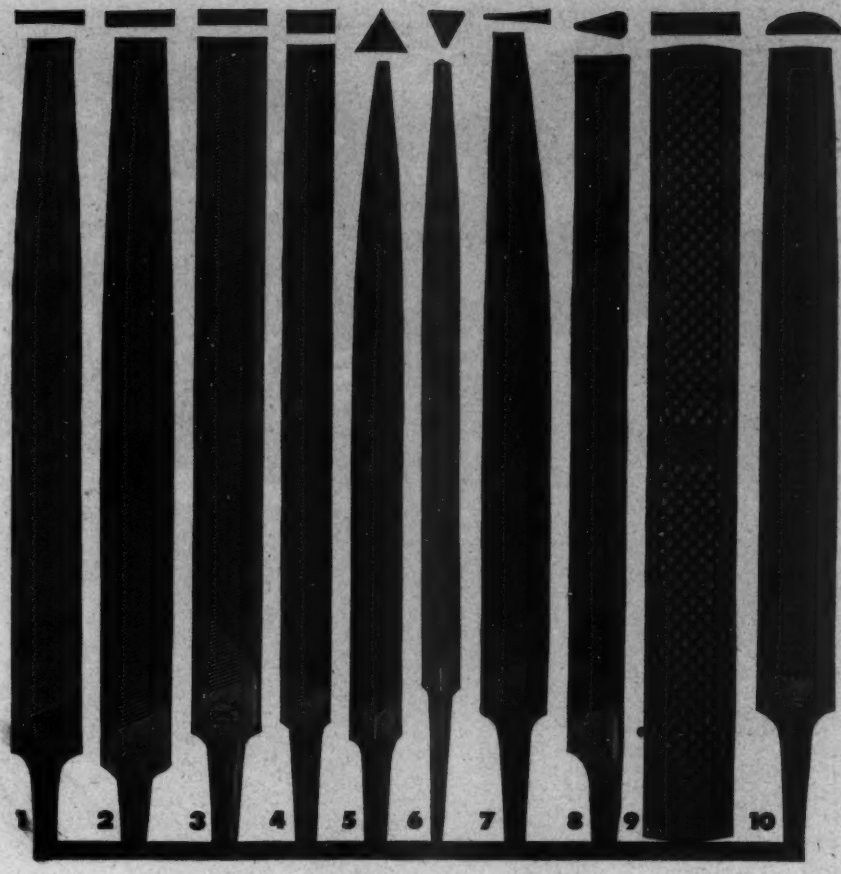

Here are ten of the more commonly known file types. Even the first-year student should be able to identify them — by their shape, cross-section and cut of teeth. Check your "score" against these ANSWERS.

1. MILL FILE. Single cut. So named from its original use in sharpening mill saws. Square edges, but also made with both edges rounded. Widely used for all kinds of smooth filing.

2. FLAT FILE. Similar in shape to Mill file, but double cut. For rough filing (fast metal removal) generally.

3. HAND FILE. Similar to Flat file but parallel in width, and with one edge "safe" (uncut). Popular machinists' file.

4. PILLAR FILE. Similar to Hand file, but thicker and not so wide; one "safe" (uncut) edge. Used principally for filing slots, keyways, etc.

5. THREE SQUARE (or "Triangular") FILE. Another machinists' file—used on internal acute angles, for clearing square corners, etc. Double cut.

6. TRIANGULAR SAW (or "Taper") FILE. Used for filing saws with teeth of 60° angle. Single cut. Made in various thicknesses.

7. KNIFE FILE. Has knife-like cross section. Used principally by machinists and toolmakers for work on narrow acute-angle slots.

8. CROSSCUT FILE. Used for sharpening crosscut saws. Rounded back is used for deepening gullets.

9. HORSE RASP. Used principally by horseshoers. Has rasp teeth on one side, file teeth on the other. May be held at either end.

10. CABINET (or "Wood") RASP. Used by cabinetmakers, wheelwrights, and woodworkers generally. Both sides are rasp cut.

INDUSTRIAL ARTS and VOCATIONAL EDUCATION

VOL. 33 MAY, 1944 Number 5

Supply Postal Zone Number for Your Magazine

If you live in one of the 124 cities where postal zone numbers are necessary, please send us your number unless the wrapper on your magazine already carries the number between the name of the city and the state. It is imperative that this full address be used in the future to insure delivery of your mail. Just clip impression from wrapper, paste it on a post card, add to the zone number, and mail it *today!*

Summer School Opportunities

Some teacher-training institutions which will offer summer sessions during the coming vacation period are shown herewith:

Bradley Polytechnic Institute, Peoria 5, Ill. Three 30-day terms, beginning May 1, June 12, and June 17.

Oregon State Agricultural College, Corvallis, Ore. The summer session — June 19 to July 28.

Pennsylvania State College, State College, Pa. Summer sessions — June 5 to June 23, June 26 to August 4, also August 7 to August 25.

State Teachers College, California, Pa. Summer sessions — June 5 to June 23, June 26 to August 5, also August 7 to August 25.

State Teachers College, Oswego, N. Y. Summer session — July 5 to August 11.

The Stout Institute, Menomonie, Wis. Summer sessions — June 19 to August 18. Three-, six-, and nine-week courses.

University of Minnesota, Minneapolis, Minn. Two terms — June 12 to July 21, and July 24 to August 25.

University of Wisconsin, Madison 6, Wis. Summer session — June 24 to August 18.

Wayne University, 467 West Hancock, Detroit, Mich. Work in war industries and learn in Wayne University. Main session begins June 19. Six-, eight-, ten-, or 12-week courses.

This Month's Cover

The picture chosen for the May cover shows how a partly finished pursuit ship is lowered into a rolling cradle preparatory to its start down the assembly line where wings, landing gear, controls, and other essential parts will be added. — *Official O.W.I. photograph.*

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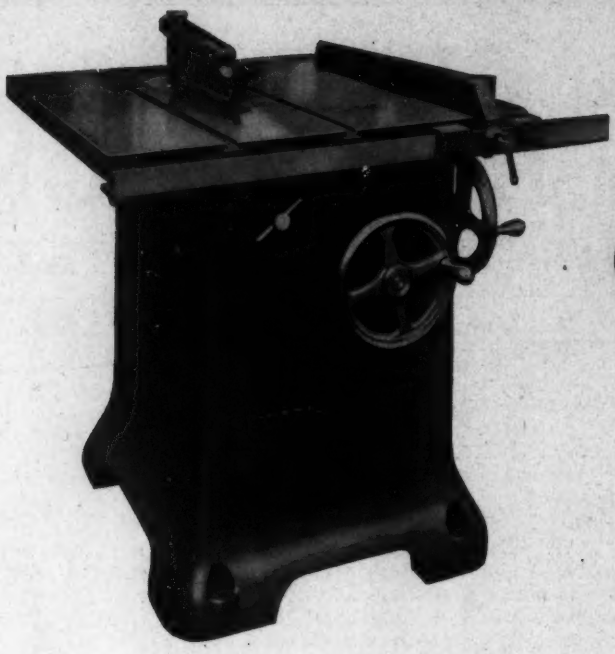


G-87
CIRCULAR SAW

No. 53 of a Series

It is generally agreed that the circular saw is one of the most widely used machines in the school shop. Logically then, it should be convenient to use and easy to operate. Instructors in shops equipped with the Yates-American G-87 Circular Saw are quick to testify that it is a saw which fully meets this requirement.

First of all, it has a tilting arbor. This is exceedingly important, for in permitting the table to remain level at all times, it enables the operator to work in a comfortable and efficient position. The swinging frame which tilts the saw arbor and motor unit is easily operated. Vertical adjustment of the saw is also very easy to make.

The heavy base of this saw gives it stability and rigidness which eliminates the necessity of readjustments once the machine is set. The base is open at the floor to provide ample foot room. A large table makes it easier to handle long stock.

Two swivel cut-off gauges with a connecting yoke are provided to simplify many of the operations which can be performed on this saw. The double-face rip fence can be used on either side of the blade.

All controls, of course, are located within easy reach of the operator — just as you might expect them to be on a saw which is so well adapted to teaching as this one is.

YATES-AMERICAN MACHINE COMPANY • BELOIT, WISCONSIN

SHORT TALKS ON WOOD

WESTERN LARCH (*Larix occidentalis*)

Related to the Eastern Larch, and like that tree is often known as Tamarack. Is much larger than the eastern species. Produces a wood, which, for a conifer, is unusually durable, heavy and hard. Reddish-brown in color. Takes a very good finish.

A satisfactory wood for both general construction and interior trim. Its hardness, pleasing appearance and ease of finish also recommend it for the manufacture of furniture. Its durability makes it useful for railroad ties and fence posts.

Found in a restricted range from southern British Columbia through the Cascade Range into northern and eastern Oregon, and into northern Idaho and western Montana. Makes its best growth in deep, porous soil. Intolerant of shade. Very slow growing.

A large tree. Often attains a height of 200 feet and a diameter of 6 feet. Narrowly pyramidal in shape. No other tree supports so large a body with so little foliage.

The bark is very thick, reddish-brown in color and is broken into heavy plates. The needles are from 1 to 1½ inches long and are borne in clusters of 14 to 30. They fall in autumn, a peculiarity which makes identification of this tree very easy since all other conifers retain their needles. The cones are about 1 to 1½ inches long and have long, slender bracts protruding from between the scales.

YATES-AMERICAN

What Industry Asks From High School Machine Shops

WALTER J. BROOKING*

"Briefly, industry expects high schools to train their machine-shop students in the fundamentals which are the tools in the hands and minds of machinists and mechanics."

Probably the most outstanding single mark of our age is the extent to which machines contribute to the processes and institutions of our modern living. Hand in hand with this high degree of mechanization is the ever increasing demand for good machinists and skilled mechanics to design, build, and maintain the machines with which we are surrounded.

This fundamental need in our social structure today is not one for ordinary machine operators nor for mechanics whose training and ability restricts them to the routine servicing and repair of simple machines, but rather is expressed in a tremendous need for men with natural mechanical abilities who have been trained in the broad fundamentals of the arts and crafts associated with mechanics' and machinists' present-day problems. Men who can, by ability, experience, and understanding of their field, direct the efforts of other people or solve the complex mechanical problems which present themselves in an ever increasingly mechanized age.

In general, today's mechanized industry is the destination of most men with mechanical aptitudes, interests, and training. It is in this field, perhaps more than anywhere else in present-day society, that the need for the best efforts of the best mechanics obtainable are recognized; and it is there where the greatest progress in equipment used by machinists and mechanics is to be found.

Probably a large majority of the young people who enter high school machine-shop training courses gravitate in that direction because of some mechanical ability and some interest in the machining field, and in mechanics. Although most of them do not visualize the broader aspects nor the larger jobs (the machine-shop foremen, and superintendents or managerial positions, the tooling engineers' functions, the foremen and supervisors of maintenance work in our factories, or the designing and manufacturing of specialized machines), many of these young people are the men who will be filling those positions in the years to come.

It is quite likely that many of them are motivated by the thought that by getting some machinist experience, and some knowledge of machining and mechanical operations, they will be able to find profitable employment shortly after they have finished high school in one of the machinist trades. Many of them will not have further schooling after high school and not a small number of them will leave school before they have completed their high school course.

In marked contrast to the metal trades and machining of 25–30 years ago, today's machining operations are done for the most part by specialized machines.

Prior to the advent of the automotive industry as we know it today, and prior to the mass production methods which have existed in this country since World War I, the training of machinists was usually accomplished by a well-organized apprenticeship training, wherein the apprentice or trainee entered into an apprenticeship agreement, usually quite early in life, and worked for a specified period of time on the various generalized machines of that day.

By the time he had finished the apprenticeship training and had become a journeyman machinist he was supposed to have had practice on all of the regular generalized machines of the day so that he could present himself to an employer and confidently say that he could run all of the machines in the employer's plant and satisfactorily produce the parts and structures from the first operation until the part was completed in that man's shop.

The evolution of the machinist trade from that generalized practice where the machinist made parts from start to finish (perhaps using several different machines,

*Director of Plant Education, R. G. LeTourneau, Inc., Peoria, Ill.

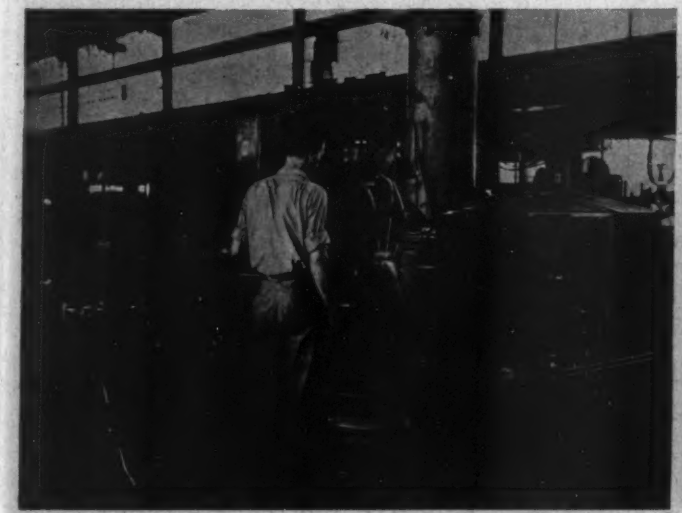


Fig. 1. A specialized machine which does lathe work

Fig. 2. A complicated large welded gear case

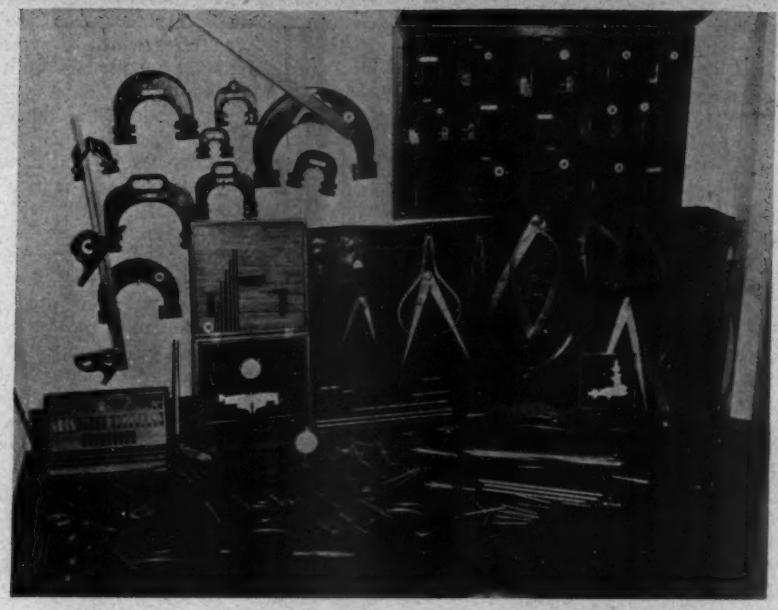
and certainly performing many different operations) to the mass production machining line where one machine and one operator performs one operation on a part and it is passed successively down a progressive line of machines until it comes to the end of the line a finished part, has greatly affected the type of operations and the type of training given to the machinist of today.

It does not require a tremendous amount of training, mechanical ability, nor intelligence to operate many of the semiautomatic machines which are to be found in today's mass production factories; but there is a greater need today than ever before for skilled machinists and good mechanics, not to operate the machines, but rather to design, build, and maintain these machines.

It is this latter type of machinist and mechanic which the high schools should visualize in their machine shop training courses. The last formal education which many of these men get is in the high school years. Bearing in mind the fact that the students are being trained for a specialized industry, and being also mindful of the fact that in most cases it is not possible to specifically train high school machine-shop students for specific positions in any specific local industry to the exclusion of all other industries without doing injustice to some of the students, the high school training problem in machine shop must, of necessity, confine itself to a broad program of generalized and fundamental training.

This does not mean that specific specialized operations should not be undertaken in the high school machine shops, but rather it means that the fundamental approach to the training of high school machinists should be from the broad basis of the general fundamentals of processes, machines, tools, materials, methods, and practices of the day.

With due recognition for the human equation and realistic understanding of the interests and capacities of the average high school student of machine shop, it must be thoroughly understood that *all* of the major fundamentals of machining practices of today *cannot* be thoroughly mastered by any high school student; but in keeping with the vision of training machinists and mechanics, not machine operators and unskilled machine servicemen, the high school machine-shop student should have himself exposed at least to the following fundamental aspects of his field.



(Above) Fig. 3. Many types and forms of metal cutting tools.
(Below) Fig. 4. Measuring devices of a variety of form and construction

Machining Operations

The machining operations are to cover the entire range of common processes in machining such as: drilling, turning, boring, grinding, broaching, knurling, etc.

Machines Upon Which These Fundamental Operations Are Performed

Not only the general form of the machine and the general knowledge of the component parts of the machines should be presented, but also a consideration of the fundamental mechanics of these machines.

The opportunity to see inside the working parts of such machines and to visualize and *think through* the mechanical flow of power, control of motion, and other mechanical processes involved in the particular machine, is a real contribution to the young machinists' education as well as a refreshing experience during the learning process.

In this consideration of forms and type of machine tools, it would be desirable to be able to present the variations in machine structure from the older types of machines (such as used, say, 30 years ago and driven from a main line power shaft by pulleys and belts), and the present-day electric motor-driven, geared-head type of machine. It is well for the young machinists to have the opportunity to know a little bit about these differences in machine construction and also to have had the experience of trying to make parts on old and partially worn-out machines as well as on new modern equipment.

A brief study of the use of electrical controls, electric motors, and switch construction would not be out of order in dealing with modern machines. In the same way, hydraulic machines should be studied, since many of the modern machines employ air or hydraulic vises and hydraulically actuated parts.

Cutting Tools and Metal Removal

The fundamental consideration of what actually happens when a tool removes a piece of metal from a part during its machining and what happens to that chip after its removal is a fundamental prerequisite to the study of the forms of cutting tools such as reamers, drills, broaches, milling cutters, lathes, tools, and grinders.

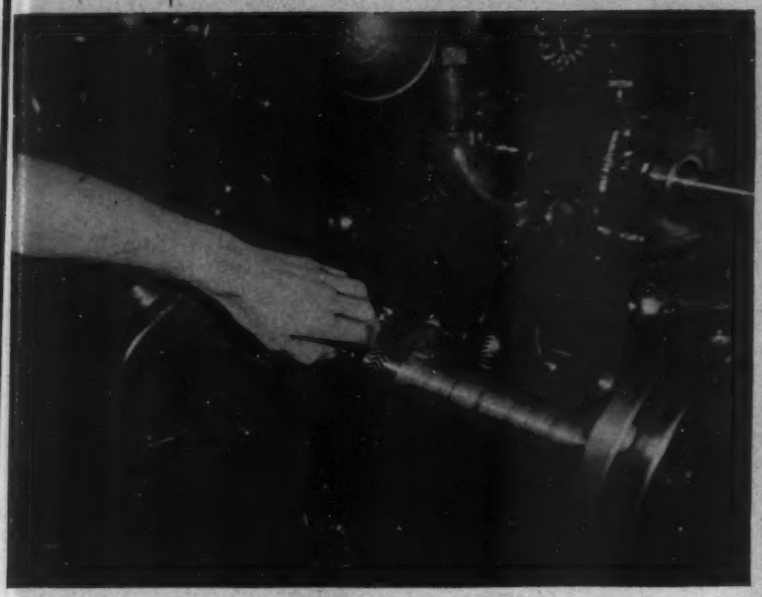


Fig. 5. Studying common coolants and cutting compounds

Fig. 6. Multiple operation jobs such as drilling over 20 holes simultaneously in this gear case

There are numerous charts and even some motion-picture films available which show what is actually done to the metal by the tools in the metal removal, and formal presentation of such information along with the practical operation of a machine may make the difference between mechanical *going-through-the-motions* type of operators and intelligent machinists.

Holding Devices and Their Relation to Successive Machining Operations

A consideration of such holding devices and methods as air and hydraulic vises, chucks, and clamps, as well as the study of *holding down* techniques and operating on centers to maintain certain relationships between one machining process and the next, is a part of every young machinist's stock in trade. The wider variety of mechanisms and the more vivid the understanding of the underlying principles of maintaining one relationship to the other, the more resourceful the machinist is likely to be.

Measuring and Inspection Devices for Machine Operation

Some contact with devices such as micrometers, dial gauges, snap gauges, scales, protractors, etc., must also be presented to the young machinists in order to complete the picture of the fundamental thinking which underlies most machining operations. Again, the wider the variety and the more vivid the impression of the application of these tools of accurate measurement, the more resourceful the machinist is likely to be.

Materials Machined in Modern Machine Shops

Although it is probably impossible to get a specimen of each of the wide variety of general classes of materials which are used in modern machine shops, some consideration of the fundamental differences between the machining of steel, brass, cast iron, aluminum, copper, magnesium, and plastics should be considered.

It would be folly to advocate that a high school student should know the intricate differences in tool grinding and in speed operations for the machining of all these materials, but the high school student should know that there are *differences* between the machining of each of these materials, so that he will not have a disappointing surprise when confronted with the problem of machining a material that is different from that which he has practiced on during most of his learning period.

Coolants and Lubricants

Here again is a subject which it would be impossible to teach in any great detail, but it would be of definite help to young machinists to know that there are a wide variety of materials which may be used in machining operations to cool and lubricate the cutting tools; and that to use the correct type of material sometimes makes the difference between a satisfactory job of machining and one which is impossible.

A consideration of the general classes such as: soluble oil, compounded cutting oil, kerosene, turpentine, carbon tetrachloride, etc., would be certain to increase the resourcefulness of the intelligent young machinist.

In many large manufacturing organizations today the technical staff (laboratory) or the machine superintendent prescribes the type of coolant or cutting compound used for most machining operations. However, in many of the smaller (and none the less significant from the standpoint of employment or mechanical development) machine shops, there is little complete knowledge or imagination used in choosing the coolants used.

Production Jigs and Fixtures

It is well recognized that in the average high school machine shop it is neither practicable nor desirable to set up very many operations which use a mechanical fixture to greatly increase the speed of the production of parts; and yet some consideration should be given to these mechanical devises which automatically accomplish the layout of parts and the controlling of the machine operations in order that the student gets a true vision of modern machine-shop operation and fundamental machine-shop practice in modern industry.

If the simple idea of a drilling fixture with a hardened bushing for the location of a certain drill could be used with a description of the fundamental idea back of the use of such fixtures, it would probably contribute considerably to the understanding of the possibility of simplifying machine operations beyond the tedius manual laying out and positioning of every part.

Supplementary Fundamental Training

In addition to the exposure to the foregoing fundamentals of machine-shop practice and training, there are certain supplementary fields of information which greatly enhance the young machinist's usefulness to himself and opportunities for the mastery of larger and more responsible jobs in today's machining industries.

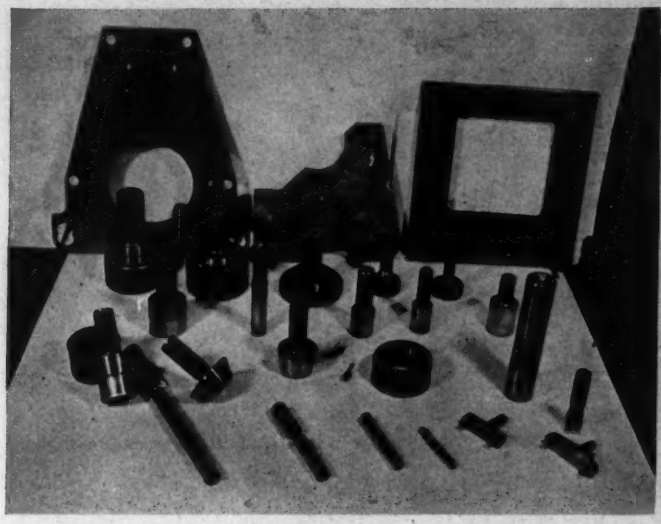


Fig. 7. Plug gauges and other similar inspection devices

Fig. 8. Blueprint reading and applied shop mathematics

These phases of supplementary training might be considered essential tools in the hands and minds of all modern machinists and mechanics to an extent which is not commonly held by educators and manufacturers. Chief among these considerations are the following subjects:

Shop Mathematics. The approach to arithmetic and other mathematical processes from the standpoint of applied shop mathematics seems to be one of the best methods of teaching shop vocabulary and also presenting the concept of counting, numbers, fractions, decimals, and geometry which are required for the successful execution of even the more simple jobs in a machine shop. The "transfer of training" of pure mathematics into shop mathematics terms by the average high school student in a machine shop does not seem to be very great.

One thing which should be stressed in shop mathematics for machinists is the intelligent use of tables such as may be found in the *American Machinists' Handbook*,[1] or in the *Machinery's Handbook*,[2] or in the literature which comes with machines as sold by the vendors of such machines. Tables of feeds, speeds, areas, square roots, diameters, radii, etc., are readily available; and if the young machinist learns to use them intelligently he will avoid spending hours of calculation and making numerous mistakes which he otherwise would be likely to make.

Learning to depend upon tables and to use them seems ordinarily to precede the intelligent questioning of the source and derivation of those tables. If the use of them is taught first, the imaginative and thoughtful young machinist will inquire into and discover the fundamental sources and calculations back of those tables.

Blueprint Reading. Blueprint reading is a relatively simple subject and may be taught in sufficient detail in from 30–45 hours of classroom study without home study.

It is an essential tool in the hands of any advanced machinist, or even machine operator, and to understand the fundamentals of relative positions on a print, dimensioning, etc., is to have a tool in the hand which is a tremendous timesaver.

Sketching and Surface Layout. The ability of any man in a machine shop or mechanical job to be able to think on paper and to effectively sketch the plans of mechanisms or fixtures which he visualizes is a tremendous asset to that workman.

To do this he does not need to know mechanical drawing. All that is required is to be able to roughly sketch and dimension the component parts of the machine or fixture which he visualizes, and by so doing to put in concrete form on paper an idea in such form that his superior and associates or one of his staff may work out the details and build the unit.

Many a good idea has been lost simply because the mechanic or machinist who conceived it has been unable to describe it and *sell it* to the proper member of the organization. Since most of the good ideas which increase production and which bring about advances in today's machine trade arise from the man who is doing work closely related to the field in which developments are made, it is almost imperative that the young machinist or mechanic have that *selling* or *promoting* practice and ability.

Safety Consciousness. One of the most awful and significant wastes in our present-day economy is that of man power due to industrial accidents.

During the year of 1941, alone, there were over 460 million days of work lost because of industrial accidents.

In many large industrial organizations, all workmen in all departments are required to wear safety goggles and safety shoes. It would not be unreasonable nor impractical to inaugurate the requirement of wearing safety glasses in all high school machine shops and it would probably be a step toward the training in safety consciousness which would be of tremendous economic value to industry as well as prevent untold human suffering from needless accidents.

Many of the more progressive high school machine shops at the present time require their high school students to wear such safety goggles during class time in the machine shop. This is very commendable and should be made a much more common practice.

Sources of Information. If the high school student in machine shops could be led to the habit of the orderly search for information on the problems which he is approaching, he would have recognized a need for study which he will always have and which he must always use to be successful in his trade.

There are many sources of information which deal directly with many of the problems which a machinist or a mechanic in the machine shop encounters.

Chief among these are the various handbooks, the operators' handbooks, and lists of compiled information which are made available by the manufacturers of machines, tools, and other machine-shop supplies; and the various trade magazines which are on the market today and which, in their editorial and advertising sections, present the new developments in the field.

If young machinists have had experience in looking through some of these sources of information and finding an idea in them which can be used in their daily work, much will have been accomplished in the direction of making them conscious of the need for study and the availability of information on problems which are of interest to them.

[1] McGraw-Hill Book Co., Inc., New York City.
[2] The Industrial Press, New York City.

The High School's Advantage in Training Machinists

The high school has a place of first importance in the teaching of the various fundamentals which are required to make better machinists and mechanics, and have an opportunity for education which is unequaled in any portion of our present educational structure.

Many of the students who gravitate to the mechanical arts and machine-shop classes are students who have considerable mechanical ability and mechanical aptitude and very often are so constituted that they are, by their very nature, *born tinkerers* and who have never learned to take abstract information from the printed page in the way that must be done to be proficient in some *classical* subjects.

The fact that these students are constituted in this way is no reflection upon them as students or as intelligent and potentially useful citizens. It is men of this type who have been responsible for many of the most important scientific and mechanical developments which have contributed so much to our present-day mechanized industry. Certain things probably should be recognized about these students:

1. They frequently are not the best readers.
2. They usually do not go to school beyond high school.
3. They would rather have tools in their hands and explore their way through material or mechanical problems than to be told about them or to read about them. By working on the actual subject they learn, whereas they may not learn by having the subject described to them or by reading about it.

Motion pictures, as they are presented today, seem effectively to bridge a gap between reading and lecturing, and they present a mechanical exploration method of learning for many of these students. The making and using of models and apparatus also presents an opportunity for teaching which cannot be equaled where certain phases of the subject matter cannot be taught by actual practice.

The high school can help its machinist students most if it exposes them to the fundamentals and the supplementary subjects just described, without attempting to give them too much specialized training. Industry can then take them and give them the specific training required by its particular methods and processes. This cooperation between school and industry will give the learners the best opportunity to develop their talents and to render the greatest measure of service to society.

"A guidance program in the schools is comprised of three parts — (1) study of individuals and their abilities; (2) study of occupations and their requirements; and (3) the use of devices in matching pupils with jobs." — *Homer J. Smith.*

For age and want, save while you may;
No morning sun lasts a whole day.
— *Benjamin Franklin.*

Industrial Safety at a School of Vocational and Adult Education

ROY R. VAN DUZEE* and JOHN G. AUSMAN**

Safety education classes opened at the School of Vocational and Adult Education, 1216 South 71st Street, West Allis, Wis., Friday, October 30, 1942, at 8:00 p.m. Classes were organized in four areas — machine shop, sheet metal and welding, foundry, and electrical and plant maintenance. The classes were made up of shop foremen, superintendents, safety engineers, and key workers interested in making the industrial fronts safe for workers and their families. These classes were the result of a cooperative effort on the part of men in industrial plants in the city, who formed the West Allis Industrial Safety Council, and the West Allis School of Vocational and Adult Education to provide specific instruction designed to help the worker work safely.

The West Allis Industrial Safety Council was organized to promote healthful and safe practices in industrial work. The first meeting was called by the director of the vocational school and was attended by about 25 plant superintendents, foremen, safety engineers, and production engineers. The problems of safe practices within the industrial plants were discussed. It was agreed that an organization which had as its purpose "the general promotion of industrial accident prevention in the city of West Allis and the area normally served by the West Allis School of Vocational and Adult Education" should be formed. The usual procedure was followed in electing officers, forming a constitution, and the selection of committees. Reference to the constitution, which follows, particularly to Article III which shows the purposes of the council and to Article IV, Membership, brings out the fact that the council is particularly interested in an educational plan which has as its specific purpose to reduce industrial accidents.

*Director, West Allis School of Vocational and Adult Education, West Allis, Wis.
**Trade and Industrial Co-ordinator, West Allis School of Vocational and Adult Education, West Allis, Wis.

Constitution and Bylaws of the West Allis Industrial Safety Council

ARTICLE I

Name

Section 1. The name of this organization shall be the West Allis Industrial Safety Council.

ARTICLE II

Location

Section 1. It shall have its principal office at the West Allis School of Vocational and Adult Education, 1216–1230 South 71 Street, West Allis, Wis.

ARTICLE III

Object

Section 1. The primary objective of the West Allis Industrial Safety Council shall be the general promotion of industrial accident prevention in the city of West Allis, and the area normally served by the West Allis School of Vocational and Adult Education to:

(*a*) Provide contact with safety engineers and directors for conference discussions on accident prevention problems and the administration of an educational program of benefit to the citizens and industries located in the area served by the council;
(*b*) Cooperate with local, regional, and national safety organizations, industrial employers in Wisconsin, and other agencies interested in the promotion of accident prevention in the states;
(*c*) Cooperate with the National Safety Council in encouraging membership of Wisconsin employers and securing an attendance of Wisconsin delegates at the annual safety congress and arranging special activities for the advancement of such delegates;
(*d*) Cooperate with the West Allis Safety Commission, Wisconsin Council of Safety, the Wisconsin Industrial Commission, the Motor Vehicle Department, the Wisconsin Highway Commission, the Wisconsin State Board of Vocational and Adult Education, the Wisconsin State Board of Public Instruction in their accident prevention and health activities, and the Wisconsin State Board of Health.

Section 2. The West Allis Industrial Safety Council shall be civic in character, nonprofit, and noncommercial.

ARTICLE IV

Membership

Section 1. Membership in the West Allis Industrial Safety Council shall be limited to two

representatives of each of the following industrial organizations:

A. The Industrial Organizations in the area served by the Council
B. The West Allis School of Vocational and Adult Education
C. The West Allis Safety Commission
D. The Wisconsin Industrial Commission

ARTICLE V

Meetings

Section 1. The meetings of the West Allis Industrial Safety Council shall be held quarterly at the West Allis School of Vocational and Adult Education in the months of September, December, March, and June of each year, and at such other times as the executive committee shall designate. The secretary shall notify the members of the council of each meeting at least two weeks in advance.

ARTICLE VI

Officers

Section 1. The officers of the West Allis Industrial Safety Council shall be a chairman, vice-chairman, and secretary.

Section 2. Officers shall be elected by majority vote of the members present at the annual meeting held in March and serve for one year or until their successors are elected and take office. They shall be subject to removal from office for cause by majority vote of the executive committee.

Section 3. Officers shall serve without remuneration.

ARTICLE VII

Procedure

Section 1. The affairs of the West Allis Industrial Safety Council shall be in charge of an executive committee composed of:

A. The elected officers;
B. Four members at large including the retiring chairman of the council, who automatically becomes a member of the executive committee for one year.

Section 2. The executive committee shall meet twice or more each year at the call of the chairman, who shall serve as its presiding officer.

Section 3. The following standing committees shall be appointed by the chairman, unless otherwise instructed by the executive committee: planning, nominating, membership, program, and such other committees as may be deemed necessary in the judgment of the chairman.

Section 4. No officer, individual, or group of officers or individuals shall appear before any local or state legislative body as representatives of the West Allis Industrial Safety Council without an authorization by a two thirds vote of the executive committee.

Section 5. Roberts' Rules of Order shall govern the conduct of all meetings of the West Allis Industrial Safety Council except as they may conflict with procedure herein outlined.

ARTICLE VIII

Quorum

Section 1. A quorum of seven members shall be necessary to transact council business.

ARTICLE IX

Amendments

Section 1. This constitution and bylaws shall be subject to amendments which shall be effective only after ratification by the majority of the members present at the annual meeting or a special meeting of the membership called for this specific purpose.

ARTICLE X

Constitution

Section 1. This constitution and bylaws shall become effective if and when approved by the membership of the West Allis Industrial Safety Council.

After full and complete discussion of the accident problems in the various industries in the area represented, the council decided on a safety program in the following areas: (1) foundry, (2) electrical and plant maintenance, (3) welding and sheet metal, (4) machine shop, (5) woodworking, and (6) material handling and transportation. It was further decided to carry on the program through offering specific, short, intensive, dynamic unit courses in the areas selected, at the West Allis Vocational School. It was felt that specific instruction in small groups by experts which would indicate how to work safely would be more effective than mass instruction of a general nature. It was also felt that pointed instruction properly motivated was more necessary and desirable at this time than the semientertaining, inspirational, large group type of meeting sometimes used to promote safety.

The program committee developed an outline for six sessions of two hours each. Course outlines were written up for each of the courses. The outline for the machine shop, which follows, is representative of the courses offered.

Machine-Shop Safety
Sponsored by the West Allis Industrial Safety Council

Session I:

1. Basic Fundamentals of Accident Prevention
   - *a*) Orientation
   - *b*) What is an accident
   - *c*) Cost of an accident — tangible; intangible
   - *d*) Records — frequency rate; severity rate; use of; investigation and summary reports
   - *e*) Responsibility — employee; supervision; management; safety organization

   Reference material found in *Industrial Accident Prevention* by Heinrich, and *Safe Practices and Health Practices*, published by the National Safety Council, and the Wisconsin Industrial Code pamphlet.
   - *f*) Discussion period

Session II:

2. General Safe Practices
   - *a*) Proper machine operation
   - *b*) Rotating machine tools
   - *c*) Air tools
   - *d*) Hand tools
   - *e*) Material — handling, storage, housekeeping
   - *f*) Discussion period

   Reference found in *Safety Always*, published by Allis-Chalmers Manufacturing Company and Wisconsin Industrial Code pamphlet.

Session III:

3. Individual Machine Hazards and Suggested Safe Practices
   - *a*) Lathes
   - *b*) Turret lathes and automatic screw machines
   - *c*) Drill presses
   - *d*) Milling machines
   - *e*) Planers
   - *f*) Material cutting equipment
   - *g*) General care of machines and tools
   - *h*) Discussion period

Session IV:

4. Machine Guarding
   - *a*) Point of operation guards — punch presses; shears; emery wheels; general woodworking
   - *b*) Gear guarding
   - *c*) Belt and pulley guarding
   - *d*) Discussion period

   References found in *Industrial Accident Prevention* by Heinrich, and *Safe Practices* Pamphlet, and *Wisconsin Industrial Code* Pamphlet.

Session V:

5. Material Handling
   - *a*) Handling by hand
   - *b*) Hoist equipment
   - *c*) Conveyers
   - *d*) Trucks and wheelbarrows
   - *e*) Piling of material
   - *f*) Discussion period

Session VI:

6. Personal Protective Devices and Reasons for Their Use
   - *a*) Eye protection
   - *b*) Exhaust systems and respirators
   - *c*) Foot protection
   - *d*) Safe clothing
   - *e*) Hand protection
   - *f*) Skin protection
   - *g*) Discussion period

The program committee realized that the instructor is the key to the successful presentation of the courses. Experts in the specific areas are therefore selected as instructors. These men are left free to either handle the sessions themselves or to bring in specialists on units covered in that particular session. At the first session, each class member receives a course outline. Usually there is a discussion at the end of the class period so an exchange of ideas may be obtained.

The vocational school takes care of the administrative details and sets up promotional plans, while members of the council who are in most cases safety engineers, personnel managers, production superintendents, foremen, or keymen, as already mentioned, select men in their plans to be included in the various classes. In most cases where tuition is required of men who live outside of the school area, the tuition and registration fees are paid for by the plant.

The instructional material outlined has been used by the West Allis Industrial Safety Council and West Allis School of Vocational and Adult Education for one year. Four sessions of six weeks each were conducted from October 30, 1942, through October 29, 1943. Three hundred seventy-five industrial workers, foremen, and superintendents attended these sessions. Twenty-three industrial firms in the West Allis area were served.

Summarizing the attendance, it was found that 143 attended all six sessions; 50 attended five sessions; 40 attended four

sessions; 48 attended three sessions; 22 attended two sessions; and 71 attended one session. The attendance and comments of the trainees has been carefully watched.

In trying to find reasons for nonattendance after registration, it was discovered that working overtime, change of shift, and Civilian Defense activities were the major factors which kept the trainees from attendance.

The usual comment in criticism of the course was that 12 hours of instruction is not sufficient time to lay a basic foundation in the fundamentals of safety training. The West Allis Industrial Safety Council is giving consideration to revising the program to make it more comprehensive and to devote more time in its presentation. Consideration is being given to a suggested program produced by the State Directors' Association under the chairmanship of Roy R. Van Duzee. The adoption of this course would lengthen the sessions by four hours, and it is believed that a more satisfactory job will be accomplished through the additional time.

The safety training plan has been very successful because: (1) it sprung from a recognized need (all plants have increased their forces tremendously), (2) the men working right in the field selected the areas to be presented and wrote the courses of study to be followed, (3) experts in specific areas are placed in charge of the classes, (4) the membership of the classes is composed of men working in the content area, and (5) the membership is determined by mutual agreement between worker and management.

Building Skilled Craftsmen for War

MARGARET STEWART*

Craftsmen and technicians are a vital part of the modern mechanized army. To the men of Britain's R.E.M.E. — the corps of Royal Electrical and Mechanical Engineers — fall the tasks of finding out what is wrong with equipment, and putting it right.

It may be the crankshaft of an army vehicle, it may be a radio, a range finder, or a Bofors gun — the expert has to be called in to cope with the situation. It isn't like doing a job in a factory. Sometimes the work has to be done in the front line, possibly under enemy fire, with the minimum of hand tools and the maximum amount of ingenuity and initiative. Farther back, in the rear echelons, there is more equipment, more spares, more machine tools, and the technician's job is correspondingly easier. But the soldier-craftsman has to be prepared for any emergency, and the training which he has undergone is designed to fit him for this.

There are three or four army technical schools in Britain, where R.E.M.E. men are trained. One of the largest, which I visited recently, is in Berkshire, with accommodation for a thousand boys. I heard it described as a *nursery;* it might be more appropriately called a *public school* or a *university*. It costs the army $1,000 per head a year — as much as many of the public schools charge for their education.

Entry is by competitive examination and there is such a demand to enroll in the school that only about 30 per cent of the applicants can be taken. The age of entry is 14½–15½; the boys stay for three years, at the end of which they are posted to various units. When they are 18, they sign on for 12 years, 8 with the colors and 4 with the reserve. They get army pay (28 cents a day during their first year, 28–35 cents during the second, and 31–41 cents during their third year) in addition to free food, clothing, medical and dental treatment. The pay, however, is credited to the boys and accumulates for the holidays; during the term they receive in actual cash from 60 cents to $1.50 pocket money according to their length of time in school.

The boys receive a thorough technical grounding, as well as practical instruction. The lowest standard of proficiency is that of improver, the boy who has mastered the fundamental technicalities of his trade; the next stage is that of journeyman, and the third that of highly skilled journeyman, equivalent to a charge hand in industry. Most boys reach the second or first stages by the end of their training; some may go further and eventually become armament artificers, roughly the equivalent of a foreman.

The three years' apprenticeship are divided into six terms. During his first month, the new boy is given a general background — a regimental instruction, general education, physical training, and games. Then he spends five months in the workshops, where he learns all about workshop practice, and how to use and look after tools and workshop appliances.

At a fairly early stage there is a selective test, and the misfits who are unsuitable for training are weeded out — in fact, less than 1 per cent of all the entrants have had to be rejected for unsuitability. At the end of his first term, the boy has to select a particular trade. His own wishes and those of his parents, as well as his individual bent or aptitude are taken into account, but the final consideration is, of course, the needs and vacancies of the army for particular classes of tradesmen.

The boy can decide to become an armorer, a mechanical transport electrician, a fitter, a turner, a vehicle mechanic, a radio and wireless mechanic, or an instrument mechanic. Throughout the training, the instruction is on a broad and practical basis, so that even though he is a specialist, he will know a great deal about the other related trades. A boy who decides to be a fitter will attend a course in electrical technology, the heat-treatment of tools, sheet-metal work, and case-hardening; he will learn about coppersmith's work and machine-shop practice and spend some months in the blacksmith and foundry shops. Again, the boy who selects armory, though he spends 16½ months in the armorer's shop, has ten months as a fitter, two as a blacksmith, and one and one half as a carpenter. As far as possible, and as soon as possible, the trainees are put to do productive work, so that time and material are not wasted.

The boys' general education is not neglected. Instruction is given in such subjects as mathematics, history, languages (if they wish), and English. A class of boys I visited were given as an essay subject to compare Napoleon's campaign with the present operations in Russia.

Great importance is attached to physical training; indeed, three quarters of an hour every day during school hours, for the whole three years, is devoted to physical training or compulsory games. The army authorities realize that physical fitness and mental alertness are of overwhelming importance in modern warfare.

The day is well filled with lectures, workshop, and drill. School hours are from 8 a.m. to 1 p.m., with an hour's break for a midday meal, and from 2 p.m. to 5 p.m. There is plenty of occupation for leisure hours. A school *union* has lately been formed, which acts as an advisory committee on entertainments and sports. The camp hall fulfills several functions, as it is used as a church on Sundays, a gymnasium, a cinema, and a concert and dance hall on other days. Films, some technical and instructional, but many of the latest Hollywood releases, are shown three nights a week on the school's 35mm. projector.

The dances, too, are popular. Partners are provided by the Auxiliary Territorial Service who work in the school canteen and office or who come from a neighboring mixed battery. The school produces a number of very fine drum and fife bands, and the commandant is anxious to get a choir started. Boxing is one of the most popular sports, next to football, and there is also hockey, netball, cricket, and billiards, and

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other indoor games. Week ends are fairly free for cycling or walking, and there are 56 days' holiday in the year.

The boys are encouraged to take up spare-time hobbies. This is important, because it is one way in which they can express their individualities.

They live in dormitories, 17 to a room. Private possessions have to be kept out of the way in a locker, though the senior boy in charge of each room can fill his cubicle as he likes. One boy's wall was plastered with pictures of film stars, another has mostly photographs of aircraft and submarines, and books on literature and the war.

This kind of life is, of course, not new to boys who have been to public schools, nor to men in the army. But it is a new experience for many 14–18-year-old boys. The training and their time at the school are bound to have indelible effects on the boys' character in these, the most formative years of their life. The boys at the army school are learning to become craftsmen, skilled in an essential trade and proud of it, with a working knowledge of other trades.

The training is recognized as an apprenticeship by the trade-unions, so that if and when the boys leave the army and enter civil life, it will be as highly qualified and experienced engineers, electricians, and mechanics. Industry after the war will be the richer for the acquisition of these soldier-craftsmen. As the commandant of the school said to me: "This is a grand scheme, and should help us to build a better Britain after the war."

Out-of-School Work in Industrial Education*

BENJAMIN J. NOVAK**

Conditions brought about by the great war are forcing all educators to think realistically concerning so-called cooperative work plans. Prior to our present period of national emergency, occupational experiences for students while still at school consisted of a relatively small number of isolated experiments which often were enthusiastically, if not widely supported. In order to assist in relieving the serious labor shortage, while at the same time providing students with the maximum of educational opportunity, the adoption of such plans on a large scale now seems inescapable.

It would appear that administrators, in setting up cooperative programs, would be wise in drawing upon the experience of others who have had out-of-school work projects functioning in the years before the war. Numerous examples have been reported in the educational literature. A partial list for convenient reference has been drawn up by Smith.[1]

It is the purpose of this article to outline briefly the plan that has been operating for the past three years at the Dobbins Vocational School in Philadelphia, with the hope that some of its features will prove helpful.

Already because of war exigencies, students have been released from classwork, either part or full time, over extended periods to assist in farmwork, retailing, postal service, and in other situations where needs exist requiring relatively unspecialized labor. There have been brought into the school Red Cross work in clothing classes, food preservation, janitorial services, making of airplane models for identification and instructional purposes, *preinduction* courses, and the like. Students rallying under the Victory Corps do voluntary afterschool work in hospitals, child care, department stores, farming, and various forms of community service. Metz[2] reports the making of machine parts for industrial concerns engaged in defense production, as part of regular school shopwork. While labor emergencies in a war economy require drastic measures, it is hoped that a preconceived plan of out-of-school work experience can result in the student's realizing an added educational value.

Many reports have appeared over a period of years of experiments in cooperative work in the commercial field by regular high schools and lately in the field of distributive education. As a matter of fact, the George-Deen Act subsidizing distributive education makes part-time work a mandatory feature.

Reports of out-of-school work plans in the trade and industrial phases of vocational education have been few. There is good reason for believing that such arrangements have not operated to any appreciable extent. McDougall[3] explains one program at Orrville, Ohio, in which boys in the eleventh and twelfth grades may alternately spend two weeks in industry and in the classroom during a 48-week school year. Part-time work in skilled trades is normally more difficult to arrange than in fields like office, stenographic, and distributive work, where a comparatively brief period of *breaking in* is required before a young person becomes useful to the employer.

The advantages and dangers inherent to cooperative work arrangements have been too fully and repeatedly pointed out elsewhere to be dwelt upon at length here. These features have been given adequate treatment by Lloyd,[4] Magill,[5] and Weber,[6] among others. It will probably be agreed that, if properly supervised, and if safeguards are provided to prevent student exploitation by employers, the advantages well outweigh the dangers during normal times, while during a crisis such as the one we are now experiencing, the benefits to everyone are incalculable.

Cooperative Work Plan at Dobbins Vocational School

The Dobbins Vocational School is a comprehensive coeducational type of school in which there are 19 full-time day vocational offerings. Vocations are represented in the trade and industrial, home-economics, and distributive fields.[7]

The trade and industrial offerings predominate, both in number of courses and student enrollment. With the exception of the plumbing and printing trades which are 4 years in length, all the courses mentioned cover a period of three years (6 terms), corresponding to grades 10, 11, and 12.

Students must have completed 4 terms of schoolwork (grades 10, 11) of an acceptable quality of achievement before being eligible for cooperative work of any sort. Parental approval must be obtained as another prerequisite. The work opportunity may be discovered by the student shop teacher, or by the co-ordinator in charge of that particular trade at school.

*Sincere appreciation is due to J. Norwood Baker, principal, Murrell Dobbins Vocational School, for his critical reading of the manuscript.

**Murrell Dobbins Vocational School, Philadelphia, Pa.

[1]Leo F. Smith, "Work — A Realistic Laboratory," INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, 31:422–4, December, 1942.

[2]John J. Metz, "The Milwaukee Experiment," INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, 31:160–1, April, 1942.

[3]R. E. C. McDougall, "Cooperative Vocational Education," INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, 28:122–3, March, 1939.

[4]Alan C. Lloyd, "Occupational Experience — An Essential of Vocational Business Training," *Education*, 62:159–63, November, 1941.

[5]Walter H. Magill, *Administering Vocational Education*, pp. 21–23.

[6]C. A. Weber, "An Evaluation of Work-Experience," *Phi Delta Kappan*, 25:39–43, October, 1943.

[7]The courses offered are: (1) automotive maintenance, (2) beauty culture, (3) commercial art, (4) child care, (5) cabinetmaking, (6) electricity applied, (7) food merchandising, (8) foundry practice, (9) home economics, (10) industrial chemistry, (11) machine construction, (12) machine design, (13) painting and decorating, (14) patternmaking, (15) plumbing, (16) painting, (17) restaurant practice, (18) sheet metal, (19) welding (absorbed temporarily for war-production training purposes).

The co-ordinator determines whether the situation and kind of work involved are of a nature which will further the learning of the student in his trade.

Several arrangements for cooperative work are now in operation. They are as follows:

1. Full-time cooperative student:
   The student must have completed 5 terms of his course at school (12A grade). He is employed in the trade full time during his sixth term. In addition to his full schedule of employment, he is required to attend six clock hours of evening classes per week; two of these hours must be devoted to related subjects. The co-ordinator, in conference with student and teachers, determines what type of school instruction is needed by the individual student. The evening instruction is given by regular day school teachers. These instructors volunteer to serve one evening a week for this purpose, with a compensating lightening of their day schedules.
2. Part-time cooperative student:
   A student may work part time in his trade during his fifth term (12A), providing that he spends at least 50 per cent of his time in regular day school classes. The co-ordinator again arranges an individual schedule which is best adapted to the needs of the student.
3. Fifth-term completion student:
   This plan was initiated recently, under the stimulus of wartime conditions. Under this arrangement a student may at the start of his fifth term go on full-time cooperative work exactly as outlined in 1. He must, however, follow this for three full school terms, the result being that he graduates at the end of the seventh term, or one term later than his class.

The co-ordinator has the responsibility of informing the employer at the start of the employment about salient features of the cooperative work policy. He is required to visit students at regular intervals at their places of employment, check upon their progress in the trade and in the classroom. At the end of the work experience the co-ordinators secure a record from the employer of the hours worked, and a report on the quality of work and attitude displayed by the student. The co-ordinator also follows up the student after his graduation. Students, as a probable result of their cooperative program, often develop the habit of returning to consult various school officials on their problems even after official connections have been severed.

A summary of the cooperative work is filed with the records of each student, and placed also on his diploma.[8]

The four-year plumbing course was organized in conjunction with the Philadelphia Master Plumbers' Association. In it the students remain in school full time during the first year. During the second and third years students spend alternate weeks in class and at work in the trade. While one student is at work, another remains at school, exchanging places each week. During the fourth year, students follow the full-time cooperative plan.

In times such as these, when a variety of positions in industry may be had for the asking, many students, parents, and even shortsighted educators question the necessity and desirability of finishing regular day school courses. The operation of brief, intensive war-production training courses within the same building, often concurrently with regular three-year day courses further increases the impatience of the full-time learners. It should not be overlooked that the vocational schools have the large responsibility of laying the groundwork for the development of future skilled mechanics and foremen. The operationally trained people developed by our war-training programs are in no sense *mechanics*, nor are they counted upon as permanent workers in this field.

If cooperative programs meet with a measure of success in retaining until the completion of courses a larger proportion of students than would otherwise remain, while at the same time assisting our wartime labor problem, their widespread adoption is justified. Despite the formidable but not insurmountable problems in administration, it is the conviction of an increasing number of educators that out-of-school work plans should constitute an important and permanent place in vocational education.

[8] B. J. Novak, "A Functional Vocational School Diploma," Industrial Arts and Vocational Education, 33:126, March, 1944.

Boatbuilding as an Industrial-Arts Course

J. A. EMMETT*

Recently in contacting a number of schools in different sections of the country in which the building of small boats has become an important part of the industrial-arts program, such satisfying results were revealed as to perhaps warrant consideration here.

Most of these schools started out on the assumption that every normal boy wants to build a boat of some sort. They recognized in boatbuilding a fine opportunity to teach skill with the hands and they found that the plan could be carried out on a modest appropriation for materials and that the facilities and tools already on hand could be used. Naturally, a high rate of student interest was anticipated but hardly to the extent that in many cases boatbuilding became an important part of the leisure or recreation time program as well.

The first requirement was, of course, the cooperation of the instructor and this re-

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Boats in different stages of construction

quired that he learn the actual methods of boat construction, usually through reading several of the good books published on this subject, preferably selecting those devoted to the building of small boats, and those written from the standpoint of the beginner or home builder. A bibliography is given at the end of this article. It has been found a good plan to make at least one of the books mentioned required reading for those attending boatbuilding classes. It may be well to have some or all of the books available for class reference. Few of the instructors contacted had had any previous boatbuilding experience, still all claimed the rudiments were easily mastered and that the finer points became apparent as the work went on.

In all cases a usable and popular type and size boat of simple construction was decided on for the first building project. Twenty feet is a safe upper limit of length for any building to be considered here, even by advanced classes, as both cost of materials and time required for the construction mount quickly as the larger boats are approached. Flat-bottom boats of the common pointed bow skiff type and the square bowed pram model will be found easy to build with lumber requirements simple and easily met. V- and semi-V-bottom boats are slightly more difficult, both as to workmanship and materials. Round-bottom boats demand special building facilities and a rather high degree of skill and should be considered for advanced classwork only. As one works up in size in any of these three types of hull models, still keeping within the 20-ft. limit, construction becomes but little more difficult, although much more time will be required.

Plans can be secured for almost any conceivable size or type of boat and one has a very wide choice for all those being considered here. Invariably plans can be had in stock form at very low cost (from 50 cents to $5). They come complete with detail blueprints and often a step by step description of the building procedure. A fairly complete list of reliable plan sources also is given at the end of this article and the instructor should contact such places to secure catalogs and literature as a guide to his choosing suitable plans. The importance of building from a proper set of plans cannot be overemphasized, especially since the cost of the plans is so low one cannot afford to run the risk of failure.

In most cases a list of the materials required for the building will be supplied with the plans with generally a choice of suitable woods for the different members given to make buying easier. Such lumber can be bought as a single bill and the few simple fastenings required for the job likely secured locally but later it will be advisable to build up a small stock of good boatbuilding lumber and marine plywood along with an assortment of proper fastenings and simpler fittings in order to be able to buy to better advantage. Materials for a 12-ft. flat-bottom skiff type will run around $15. For a more difficult type of boat, the same size is easily double that amount. Cost of materials for projects can be handled in different ways. In schools where work was commenced on a single simple boat the cost was charged to that project. It was then discovered there would be no difficulty selling such boats at a price which would at least cover cost of materials. As boys gained skill, many of them wanted to build boats of their own, supplying the necessary materials or paying the school charge and working on boats alone or as a class project.

In cases where schools have built up a good reputation for work turned out, nearby residents are only too glad to supply materials or pay for them if the school builds boats for them. Or again some of the schools were so located that a fleet of small boats were built and kept by the school on some near-by body of water with training in their handling and racing of certain types an important part of the school sports program.

The existing woodworking shop facilities invariably suffice. A 10 or 12-ft. boat to be built as the first project will require a floor space only large enough to allow a couple of feet of working room all around it. The commonest woodworking tools can be used for the entire construction if lumber is bought dressed to the required thicknesses. As a matter of fact, an important point in connection with boatbuilding as an industrial-arts project is that this is a skill or trade which has not succumbed to modern machinery or mass production methods. At the same time power tools, especially a handsaw, jointer, and disk sander, can be used advantageously if only largely as a matter of instructing in their running and upkeep. As the class gains in proficiency or increases in size, and larger or more difficult types of boats are started, the same tools and setup can be made to suffice.

The total number of hours available for such training should be considered when selecting projects. Roughly, 100 working hours should suffice for the building of a simple skiff type where the work is to be done in a painstaking way and with the thought of gaining skill on the job rather than of quick completion. Double or thrice this time will be needed for building the more difficult types, even if they are of the same size. The question of allowing students to work on their own or class projects after school hours and on Saturdays may crop up, for in many schools student interest has been so intense that such extra shop use is permitted, sometimes under guidance but often alone when sufficient proficiency has been attained.

The problem of projects to suit beginners and advanced classes is best solved by allowing the former to work on the most simple types, and to permit advanced students to attempt types of boats that are more difficult, but also more interesting and desirable.

The illustration shows the advanced stage of proficiency in boatbuilding attained in a New England boarding school where boatbuilding is an important part of the school curriculum. Here interest was so keen, that a portion of the gymnasium was turned into a boatbuilding shop and power tools were bought to augment the woodworking hand tools. A sizable fleet of boats has been turned out, ranging from 10-ft. boats which boys are encouraged to build as a first attempt up to 20-ft. boats in cabin and sailing models. A school fleet of six 12-ft. sailing dinghies has been built for those students who elect sailing as a part of the spring and fall activity. It has been found that such building ties in nicely with allied training in drafting and blueprint reading, also that a certain amount of managerial training is imparted because advanced students are required to lay out the different stages of construction in their proper sequence and to attend to estimating material and other requirements.

A large Miami, Fla., high school has for some years had a boatbuilding class as part of its regular work. There interest reached such a high point that the building set apart for such classes now covers a half block with facilities such that not only finely built small boats are turned out but a number of large cruisers and sailboats have been built for outside customers. A Barnstable, Mass., school is reported to have had a somewhat similar experience.

A Pennsylvania boarding school located inland has for some time specialized in the building of canoes, using stock molds over which this difficult to build type boat can be built. With proficiency gained by working on school or individual student boats, the boys are then allowed to start on boats of their own from any practical plan chosen in consultation with their instructor. All these boats are built to a high standard of workmanship judged even from a professional boatbuilding standpoint.

The question has been raised as to whether this plan is suited only to schools located in waterside sections. It is best answered by pointing out that there are very few places in this country not situated so as to be able to take advantage of a near-by stream, river, or lake, also that the innumerable miles of waterways being created as a result of federal power, flood control, and navigational projects will open up a new opportunity for thousands of people within driving distance of them to enjoy the recreational features which are considered as an important part of such development.

In addition to this teaching of skills in using their hands, projects of this kind have been making a definite contribution to our war effort and can be considered a worth-while background for further training in certain professions or the entering of certain trades and industries. In a number of known cases as a result of skill gained in several years of attending such classes boys have been able to secure good jobs in the large boatbuilding plants of the country. Others with a good ground-

(Continued on page 190)

INDUSTRIAL ARTS AND VOCATIONAL EDUCATION

John J. Metz, Editor

Summer School or War-Production Plant

In normal times many teachers would be seriously planning their summer school program at this time. Under present conditions, however, there are many factors that may interfere with the ordinary plans that teachers would like to make with respect to the manner in which to spend their vacations.

No doubt, many of them ought to attend summer school, but they are seriously wondering whether it would not be more patriotic to help the war-production effort by entering a plant in which munitions and other army equipment are being manufactured. When we consider the over-all picture in the various theaters of the war, anyone can see that the allies are still far removed from the final victory, even though we are sure of the ultimate outcome. Until that victory is won, however, American plants must turn out whatever the allied armies need. To do that, every man and woman who can work on a machine, wield a welding torch, or occupy a place in an assembly line must lend their aid to help make America safe against totalitarianism.

This may mean that some teachers will choose to spend their vacation in a factory or some other employment that will help our war effort, rather than attend summer school.

Quite a number, however, will feel, and rightly so, that their main effort must be spent in preparing themselves to do a better and more efficient job of teaching their students in school. These teachers will be looking for suggestions and time schedules of teacher-training institutions that will best serve their purpose during the coming summer months.

A small selected list of such institutions is shown on the table of contents page. Probably a perusal of this list will help the individual teacher solve his problem. Attention is called to the fact that some of these institutions have so arranged their schedules that students who attend can also arrange to put in some hours at near-by war-production factories. This may be an incentive, then, for shop instructors to help the war effort in two ways — by working in a war-production plant, and by attending at a teacher-training institution to improve themselves for the 1944–45 school year.

Teachers After the War

The requirements of the armed forces and the labor needs of the war-production industries have seriously depleted the supply of the industrial arts and vocational education teachers in the school shops of the country. Bad as this condition may be, there is a still more important phase of this matter, and that is that practically all of the young men who were preparing themselves to teach shop subjects are now either inducted into the armed forces, or they, too, are working in war industries.

An appreciable percentage of those who have thus been taken out of the ranks of the teaching profession will not return to their prewar positions. At present, industrial-arts classes in a number of communities have been discontinued because of teacher shortage and many of these school shops may not be opened even after the war is over because at present but few new teachers are being trained to fill the vacancies that occur day after day.

It is true that, in the present emergency, many substitute teachers have been hurriedly trained to fill the places left vacant by those who have been drafted to help in the war effort. Even this will not suffice to carry on the augmented industrial arts, full-time and part-time vocational and adult education classes plus the rehabilitation work that will have to be carried on after the war.

How to solve this problem of teacher replacement and teacher training has not as yet been discovered. However, serious study should be given to it, right now, because the time may come sooner than we expect when the work of the industrial arts and vocational education teachers will be under stress to accomplish much more with greatly reduced staffs.

It is sincerely hoped that the school-shop teachers in the armed forces as well as those who have entered industry will return to their teaching activity as soon as this war is over so that the education of the boys and girls who are now in the lower grades may not be narrowed down too much.

The emergency has shown that industrial arts and vocational education ought to be extended rather than restricted. In the postwar educational adjustment this must be born in mind, and to carry it out in practice will require that the number of shop teachers be increased.

Teachers of industrial arts and vocational education should be on the alert looking for students who have the ability and the urge to become shop teachers. A little encouragement given to these boys may assure a good crop of candidates for the teacher-training institutions, and in the meantime, they may be developed into an effective corps of teacher assistants.

Another source of school-shop teachers may be the large number of mechanics who have been put into emergency teaching positions for training war-production workers. It is true, many of these men cannot at present qualify, but some of them are sincerely interested in their teaching experiences and would like to continue as teachers. These men should be assisted by intensive courses, to gain the additional credits needed to qualify as shop teachers. Then, when the war is over, the school shop will be in a better position to do the work which postwar conditions will place before it.

Vacation Days Ahead

Some of the suggestions contained in the editorials "Curbing Juvenile Delinquency," in the January, 1944, issue of this magazine, and "Looking Ahead" in the last number, may be profitably employed in keeping many of the older boys and girls off the streets and under supervision during the greater part of the summer months. Many of the younger children, however, still will be uncared for. Of course, in cities where summer playground activities have been developed, the youngsters who come to the playgrounds are well supervised. But even here, only a comparatively small percentage of those who could take advantage of this service actually make use of it.

Probably the parents of the pupils in attendance during the school year could be contacted so that parental authority might be added to the urgent invitation from the schools to have larger numbers of the children attend the playgrounds. This would aid in cutting down the rising tide of juvenile delinquency. Now where both father and mother in many families are in full-time employment and unable to supervise the children throughout the day, such supervision is a real necessity.

Many communities, however, have no supervised playgrounds. Probably in such places the school shop might do an excellent piece of work during the vacation months by presenting a good handicraft program which would keep hands and minds of the little folks busy. Probably, too, out of this handicraft movement might grow a supervised playground movement which would give the school children of even the smaller communities an opportunity to enjoy worth-while vacations under careful supervision.

(Continued from page 188)

work in practical construction gained are considering present or postwar study of naval or marine architecture as a profession or will use it to give a better understanding of what is required for rapid advancement in office and managerial jobs in the commercial boatbuilding industry and in the different manufacturing serving this important industry. Also to be considered because it is right along the line of the training being given by these schools is the increase in growth of the pleasure boatbuilding industry prophesied for early postwar years. Figures compiled by the U. S. Department of Commerce and contained in their recent survey, "Markets After the War," place this part of the industry at the head of the list in considering anticipated booms in different industries. Surely practical training such as can be given in such classes should place students in a good position to take advantage of the many opportunities that would seem likely.

Books on Boat Construction

Boatbuilding by Howard I. Chapelle (New York City: from Yachting).

Small Boat Building by Edwin Monk (New York City: from Yachting).

Modern Boat Building by Edwin Monk, for more advanced work on small round-bottom boats (New York City: from Yachting).

Small Boat Building by Patterson (New York City: Rudder Publishing Co.).

Amateur Boat Building by W. F. Crosby (New York City: Rudder Publishing Co.).

Plan Sources for All Types of Small Boats

Rudder Publishing Co., 9 Murray St., New York City.

Motor Boating, 572 Madison Ave., New York City.

Outdoor Life, 353 Fourth Ave., New York City.

Fawcett Publications, Greenwich, Conn.

Westlawn Associates, Montville, N. J.

Cleveland Boat Blue Print Co., Station A, Cleveland, Ohio.

Harbor Plywood Corp., Hoquiam, Wash.

U. S. Plywood Corp., 616 West 46th St., New York City.

Shortage of Skilled Workers Demands Thousands of Youths to be Trained

M. J. RULEY*

There are three sources of workers at the present time, namely, (1) high school students, (2) men over 38, and (3) women. Only high school students as a source of workers will be discussed in this article.

High school students as a source of help can be classified into two groups: boys and girls who have studied some industrial subject or shop course, and those who have not. Many of the first group have taken jobs in defense plants, but the number requested is far ahead of the number who were able to do some specific job.

One plan that has been used to a great advantage and is becoming more important than ever is the cooperative training program. Under this plan students attend school one half day and work one half day, or two students holds one job, alternating between school and shop in one- or two-week shifts.

This is not new; many schools use this plan. In Tulsa, for example, over 65 boys are working in the two-week program and 29 boys are working in the half-day program. In addition to these boys in the industrial cooperative training program, there is also the distributive program in which 110 boys and girls who are employed in the retail stores are enrolled. The cooperative office training program has 56 boys and girls working in offices of the city. Consultation with school officials will show the interest that employers and schools have in the cooperative plan of training in preapprenticeship, as it may be called.

It is found that schools can knock off the rough edges of workers, and orient them through shopwork experience. For example, it is uneconomical for a company to pay wages for one to assimilate the large number of new terms, names of tools, and how to use tools when schools can accomplish the same result. Regardless of school training, the employer with whom he finds himself will necessarily have to train him in his own particular methods of production no matter how good the school has trained the youth in the school-training program.

The first step in training youth is to see what the local school board can do about courses or programs of an intensive nature in the evening school, part-time school, or full-time school during the day.

If, for example, machine operators are needed, it is economically wise to give prospective workers an intensive course in this work at one of the school shops. This course may take a week or six weeks, according to the training needed and the ability of the learner. One cannot say that a given worker can become efficient in a two-week or a six-week course.

Workers could put in a half day on the job, and an equal amount of time at the school, or they could work all day on simple jobs and attend evening classes, or they could put in all day for one or two weeks in the school and then transfer to the shop full time and perhaps take advanced work at the school in the evening.

A variety of plans could be considered, but the final judgment would be that of the employer who pays the salary of the worker.

Industry and business may profit by trying the following suggestions to alleviate the shortage of workers.

1. Use the schools for training.
   a) Set up intensive courses in industrial subjects for high school students at least 16 years of age during the summer months.
   b) Through the co-ordinators of the cooperative training program, secure and place youth on jobs for which they are best suited and most likely to succeed.
2. Hire men over 38 years of age who have previously had some training or experience along a particular line.
3. Use slightly handicapped people.
4. Hire and train this same age group to do a specific job with the aid of the War Manpower Commission's agencies for training.
5. Hire women. Married women, approximately 30 years of age, make good steady workers. They can be trained to do almost any mechanical work that men do.
6. Use school boys after school hours.
7. Attract help with adequate pay, and pay while learning.

"I see no need of limiting trade school faculties wholly to men and women of trade experience. There is as little justification for denying positions in the high schools to tradesmen. . . ." — *Homer J. Smith.*

"Our chief problem lies in the fact that all students do not progress regularly through the several units of our system. Few in fact do so. A very large percentage of both boys and girls drop by the wayside. . . . With all possible care and understanding we must maintain other and special types of training for them." — *Homer J. Smith.*

*Co-ordinator, Cooperative Diversified Training Program, Tulsa, Okla.

How to Teach an Employee

MURRAY BANKS*

A Wartime Training Program in Vocational Distributive Education

At the present time businessmen are faced with a large number of serious problems. Retailers in particular are facing challenging times. A state of war has brought with it a greatly increased strain on our national economy; particularly and directly in the field of production; indirectly — but as far reaching and ultimately affecting our lives as vitally — in the fields of distribution and consumption.

Methods of distribution affecting civilian supply have undergone many changes. Retailers recognize the need of putting their business on a war footing. In order to meet this need many communities are offering, or planning to offer, courses in distribution to meet wartime needs. A number of cities, with the cooperation of the state and federal governments, have already organized classes in distributive education for employed workers, new workers, and store executives. These programs are being geared to the needs of business and to problems of distribution arising out of the war emergency. The responsibility of functional training is recognized as we face the increasingly critical days that are ahead.

In order to guide instructors in teaching retailers and other distributive workers to meet successfully the wartime problem of on-the-job training, the Business Education Service of the United States Office of Education has prepared a series of detailed outlines and supplementary materials on various phases of distributive education.

Of the courses which have been developed by the Business Education Service, a wartime training program for store supervisors and department heads, titled "How to Teach an Employee," has proved most popular. This is a *custom-made* short course intended to aid experienced executives of large and small businesses and deals solely with the problems of how to teach both new and experienced employees more efficiently.

This course was developed on the premise that for the duration of the war and during the period of reconstruction the efficiency of our present system of distribution will depend more than ever before upon the leadership ability of junior and senior executives. Among the many problems which face retailers today, one of the most difficult problems is that of training employees on the job. Some of the new problems which must be solved through more effective personnel training are:

1. Meeting an extremely high labor turnover.
2. Using persons not naturally adapted to sales work.
3. Explaining new merchandise.
4. Handling rationed goods.
5. Introducing alternate and substitute merchandise.
6. Adjusting to new working conditions and schedules.
7. Dealing with new customer attitudes.
8. Replacing key junior executives.
9. Creating a *victory* morale on the part of all employees.

In every retail organization, the problems of breaking in new workers and of retraining experienced employees have assumed a major importance.

In a period of rapid changes in policy, practice, and personnel, an increased load is placed on the shoulders of every supervisor, department head, and sponsor. A significant part of this new load consists of teaching employees how to perform their work under new conditions. This *on-the-job* teaching is done on an individual basis, often in the department during store hours, and is in addition to any centralized training given by the store or in classes conducted by the public schools as a part of the local program in distributive education.

Every department head, in a normal period, spends a large part of his time teaching the workers in his department. In a war period, this teaching must be stepped up in efficiency. The Training Within Industry Branch of the Labor Division, War Production Board, for example, before July, 1942, offered a similar short course to over 200,000 key foremen. This training was offered with the objective of securing maximum production and increasing our nation's fighting effectiveness.

Supervisors and foremen realize that a major amount of their time is spent in teaching employees who are working under them. Store supervisors and personnel directors today feel an acute need to meet the wartime problem of on-the-job training.

The course on "How to Teach an Employee" is therefore designed to sharpen the *teaching tools* of executives so that they may do this part of their work more effectively. Executives know what should be taught, but they want help in *how* to teach it.

The techniques of teaching, which many executives must acquire in order to do more effective training, are known, and this course streamlines them to meet current wartime demands for speed. It is believed that the use of these streamlined techniques by executives in any sales organization will step up the skill, knowledge, and attitudes or morale of each employee to a new but necessary *all-out* level.

"How to Teach an Employee" is a course designed to be offered to store supervisors, department heads, division managers, owners and managers, buyers, sponsors, persons doing system training or conducting centralized training, and junior executives and assistants.

Only those persons who have themselves had this 12-hour course are selected by the state supervisors to conduct meetings in their own districts. Each person who is selected as an instructor is given detailed instructor's outlines, and the supplementary materials which serve as a background to the outlines. The instructor of these adult classes in distributive education should have an adequate background of working experience in the field, and the ability to teach what he knows about that field. He must have leadership ability and a command of effective teaching procedures and techniques.

The course involves six meetings of two hours each. A brief outline of the course follows: (This is not the "instructor's outline" as this is furnished only to those persons who are selected as instructors.)

First Meeting

1. Introduction of the course
2. Benefits to be derived through mastery of the techniques to be taught
3. Weaknesses of the common training methods
4. Illustration of recommended method for breaking in new workers and improving the performance of experienced employees

Second Meeting

1. Need of analyzing tasks to be taught
2. Organizing teaching materials
3. Instruction and practice in making *task analyses*

Third Meeting

1. The basic steps to follow in instructing an employee how to perform any specific part of his job
2. Relationship between the process of making a sale and teaching an individual
3. Principles of learning involved in teaching an employee
4. Applications of the basic teaching process to a variety of teaching situations found in business

Fourth and Fifth Meetings

1. Supervised practice in handling various types of teaching situations

Sixth Meeting

1. Importance of creating and maintain-

*Brooklyn, N. Y.

ing a relationship between executive and employee which will expedite training efforts
2. Handling special instruction problems
3. Follow-up after teaching
4. Review of teaching skills which the course is designed to improve and inculcate.

It is believed that department heads, buyers, sponsors, or other executives after having completed the 12-hour course will be able to make immediate use of the new teaching skill he has acquired when he breaks in new employees or aids the experienced workers under his supervision; and by constant use of this new skill, it is hoped that the executive can aid employees to make the many new adjustments necessary to do a real job of distribution of goods and services during the present war period.

Our Work Program Goes to War

R. E. C. McDOUGALL*

"Hello! Is this the high school office? This is Mr. Slabaugh speaking. Have you any young ladies who could help us out in our office? Another one of our people has left to join up with the WAC."

"Hello, Mack! Sorry to trouble you again, but can you dig us up a couple of high school boys to help in the plant? They have called some more of our fellows and we are shorthanded."

One or more of the above conversations sound in our high school offices every day. These requests have been coming in all during the school year of 1942–43. And it was to enable us to answer in the affirmative that led our school officials to consider the responsibility of the secondary schools of our country in a major emergency, during the summer of 1942. To meet the responsibilities, both locally and at large, seemed to require the organization of a student work program. Accordingly early in August the Orrville board of education was asked to approve the following outline of a student work program:

Orrville Student Work Program

The members and officials of the board of education urge the parents of all youth under 18 years of age to consider school plans of your children for the coming year.

Now is the time to get an education. Your government and private industry favor educated men and women, first, last, and all the time.

The United States government and private industry have few profitable jobs for youths under 18 and especially if you are not at least a high school graduate.

Your government and the armed forces urge all young men and women to stay in high school and college. Put your time on mathematics, vocations, physical science, and social sciences. The future belongs to the educated person.

Operation of the Student Work Program

1. High school boys whose parents need you on a farm may arrange for your working service for any two-week period during September and October, or during April and May. Parents should make the proper request at the school office. The two weeks need not be consecutive days.
2. Boys and girls whose schedules permit may arrange work projects and obtain permission to work at such on the following conditions: (*a*) have parents' permission to work; (*b*) secure proper work certificate; (*c*) wage rate in conformity with state regulations.
3. Members of the Future Farmer Association under the guidance of the agriculture supervisor may assist farmers to salvage crops as follows: (*a*) farmers must request such aid through supervisor; (*b*) boys must be paid a regular wage; (*c*) boys must have permission from parents to do such work.
4. Upon request every effort will be made to adjust the school schedules for working students. In the case of farm boys or others doing emergency jobs, every opportunity will be allowed to make up work or school projects missed while out of school.

Through the press and notices, the action of the school authorities was made known to students and the public. Before school opened in September, calls began to come in for workers.

As soon as school was under way, requests began to come from boys and girls, 16 years and older, for change of schedules in order to take necessary jobs in the community. Calls from farmers to pick apples, potatoes, and harvest corn were common occurrences.

One case comes to mind where a farmer asked for help to husk his corn. A class of boys under the direction of the agriculture supervisor worked out a project whereby the farmer had his corn husked by the boys, who in turn sold the fodder to the city park board to protect the swimming pool from frost attack.

In this project, a farmer was aided to save his corn crop to help feed the nation, the boys secured valuable experiences and financial remuneration, besides rendering helpful services to the local community.

This same group of young men participated in the county scrap drive, receiving $165 for their share of the funds. They gave a check of $50 to the Red Cross, another check of $25 to the Blue Star Mothers, bought a $25 war bond, and put the balance in the bank for similar activities in the future.

During the month of January, 1943, a work survey was conducted under the direction of A. L. Baumgartner, principal of Orrville High School. Information was desired as to the actual number of working students in the defense industries of the community, as well as students doing odd jobs in the community. Factors about the type of work, working hours, and the students' estimate of the working conditions were investigated.

TABLE I
Student Working Program on School Time

Type of Work	Boys	Girls
Housework		5
Food manufacturing	14	3
Office work		6
Local stores	7	11
Trades and Industries	12	
Utilities	11	
Service stations	2	
Miscellaneous	7	
Totals	53	25

Some of the students in this group are using as much as four school periods on their industrial jobs. A number are working four- and six-hour shifts daily. All students average between 15 and 20 hours weekly. A total of between 1100 and 1200 work hours are being turned in weekly by these working students. The hourly rate of pay for these young workers is between 40 and 50 cents.

Comments by the students about the work they are doing is generally favorable and of interest to individuals interested in the activities of youth.

"My job deals with checking tires and servicing cars, to keep them on the road. This work helps me financially and gives me something to do."

"It is important that I earn money while I attend school. Since my work is in a defense plant, I feel that I am doing a very necessary work."

"I want to keep this job until the draft gets me. My earnings help me to stay in school, and the plant where I work is turning out war work."

"This plant is making supplies for the army. I like to work here, and I invest 10 per cent in bonds."

Our survey included reports from students doing odd jobs before and after school, as well as on Saturdays.

The operation of the program indicated in Table I has led to some interesting conclusions:

The young men and women of our high school have made a worthy contribution

*Superintendent, Public Schools, Orrville, Ohio.

to the depleted man-power occupations of our community. Many skills and abilities have been developed and put to work that might otherwise have been wasted. A number of youths have had opportunities to explore interesting and existing vocations and occupations. Some of the usual disciplinarian problems have been absent by keeping precocious youngsters busy at interesting and necessary tasks. Perhaps the outstanding contributions were the community cooperative policies that have been active during the past year. These working experiences have helped young people to differentiate between privileges and responsibilities.

TABLE II
Students Working on Own Time at Off Jobs

Type of Work	Boys	Girls
Child care and housework		30
Clerking in stores	5	15
Coal and elevators	4	
Farms	31	22
Factories and industries	7	
Garages	5	
Milk products	6	
Paper carriers	20	
Recreation centers	21	
Waitress work		4
Woodworking plants	2	
Totals	101	71

It is only fair to report that a student work program can create some headaches for the school authorities and administrators. About 25 per cent of the young workers have to be constantly reminded that schoolwork must come first. After the first or second pay check, young people easily assume that the school program is simply operated to accommodate the work program. Another situation that complicated the work certificate situation was the unannounced changes of the young workers from one employer to another without making the necessary reports to the school office. Young workers soon learn the difference between employers who pay the higher wages.

Such a work program does not work of its own accord. It requires considerable supervision, a flexible disposition, and a strong belief in the value of work experiences for young people. The tremendous demand for workers of all kinds has naturally simplified the locations for employees and the payment of wages for work performed.

Every activity demands effort and management. The glowing reports and interest of many of our youngsters has been a measure of compensation. The appreciation and cooperation shown by our local employers has been a source of satisfaction. Our young people are becoming responsible citizens in the educational and working institutions of the community. We expect to continue our work program for the duration as a part of the Victory Corps Program.

Chicago's Apprentice Training Program Pays National Dividends

PHILIP L. McNAMEE*

Under the leadership of Dr. William H. Johnson, superintendent of schools, and the sympathetic president of the Chicago Board of Education, Mr. James B. McCahey, vocational education has had a chance to thrive in Chicago. The recognition of vocational education as an important phase of public school work, made evident by the school staff reorganization which provided for an assistant superintendent in charge of vocational education, has made possible the formulation and execution of an apprentice training program that has not been equaled elsewhere. Several of the building trades programs have gained national recognition and have been adopted as the national standards of apprenticeship in their particular fields.

However, this was a peacetime program; it was not spectacular. The first goal was to train young men for peacetime industrial pursuits.

The Washburne Trade School, located near the center of the city, operating as a Smith-Hughes school, has given training to thousands of building trades, machine tool, graphic trades, and needlecraft apprentices. With this outstanding peacetime program as a background, it was easy in July, 1941, to speed up the regular Chicago program and make it available to a larger group by means of a 24-hour day program and the utilization of ten high schools. However, the apprentice training programs were not curtailed. They were expanded. Within the past year, training programs have been established for railroad apprentices from the Chicago, Milwaukee, and St. Paul shops; and apprentices working in making molds for plastics; patternmaking; and foundry. All of these are long-term programs, with a school period of from five to eight hours per week paid for by the employer.

As the war program of the nation progressed, and the young men who had a desire to enter the service began to enlist, there was early evidence of the value of this type of training. Many of the young men desiring to enter the Navy found that they were extremely welcome in the technical phases of this military branch. Special ratings were received easily by those who had had training in the machine tool trade.

The school has attempted to keep in contact with all apprentices who have entered the service. To accomplish this purpose, a mailing list has been kept up to date, copies of the school paper have been sent to all instructors and apprentices in the service, and at Christmas time 557 Christmas boxes were sent out to them. These young men, scattered all over the world, are corresponding regularly with their former instructors and fellow students.

Evaluation, from an entirely different angle, of the apprenticeship training which has been carried on in this public school may be made from the attainments of apprentices in the service. Following is a list of the numbers and the ranks attained.

Army	
Captain	2
Lieutenant, First and Second	13
Sergeant	23
Corporal	27
Private, First Class	14
Private	128
Marines	
Corporal	2
Fireman, Second Class	2
Steam Fitter, Third Class	1
Private	16
Navy	
Ensign	2
Chief Petty Officer	1
Petty Officer, Third Class	1
Carpenter's Mate	13
Electrician's Mate	14
Machinist's Mate	1
Fireman, First Class	2
Fireman, Second Class	10
Fireman, Third Class	8
Painter, Third Class	3
Fitter's Mate, Third Class	1
Radio Technician	1
Aviation Metalsmith	1
Aviation Machinist's Mate, Third Class	11
Boatswain's Mate, Second Class	1
Steam Fitter, Second Class	2

*Assistant Superintendent, Public Schools, Chicago, Ill.

Steam Fitter, Third Class	8
Yeoman, Second Class	1
Seaman, First Class	28
Seaman, Second Class	32
Apprentice Seaman	56

Air Corps

First Lieutenant	2
Second Lieutenant	24
Sergeant	10
Corporal	5
Private, First Class	3
Private	43

It is evident, from the large number of apprentices who have attained a rank, that something has been given along with the apprenticeship training which can be evaluated in terms of leadership and special ability needed by an officer in the armed forces. One might think that, due to the fact that we have now a mechanized Army, it would be natural for trainees in mechanical lines to attain a rank. An interesting fact is that young men serving an apprenticeship in the building trade have been able to attain promotion as quickly as those who were serving an apprenticeship in the more mechanical phases of industrial work. Of the 61 plastering apprentices entering the service, there are:

In the Army: 6 Lieutenants; 4 Sergeants; 3 Corporals

In the Marines: 1 Corporal

In the Air Corps: 1 Lieutenant; 1 Sergeant; 1 Corporal

In the Navy: 1 Chief Petty Officer; 1 Yeoman, Second Class; 3 Seamen, First Class; 2 Seamen, Second Class

A total of 24 who have attained special ratings.

Stimulated by this additional proof of the value of apprentice training and a realization of the great demand for men trained in peacetime pursuits which will be felt immediately after the war, Chicago is attempting to retain all apprentice departments and to expand facilities for such work.

Three Essentials of a Functioning Guidance Program

HAROLD M. GRAY*

The most effective training possible for citizenship in a democracy is practice in democratic living. Practice in democratic living may come about most successfully by planned programs of guidance and self-direction of individuals from a social and economic viewpoint.

When we speak of guidance, we like to think of it as intelligent direction of young people, in accordance with their needs, interests, and abilities, toward life goals — as they exist in this present complex economic society.

When we think of a *functioning guidance program*, we are thinking of a program with a purpose — one that helps every boy and girl to grow and achieve to the fullest extent of his ability, thus making them acceptable, desirable, and productive citizens of a democracy that fits into our modern complex economic society. We like to think of the program as helping each individual become adjusted to this world in which he lives — perhaps we should say — creatively adjusted to it. Mere adjustment may mean accepting the situation and reacting accordingly. Creative adjustment is giving to the situation the most one has to offer in order to better that situation.

Certain things should take place before organizing a program of guidance, if we wish that program to be successful. In instituting guidance programs, many schools have failed to recognize fundamental essentials, and hence their programs have failed.

The three essentials of a functioning guidance program are: (1) to know the pupils or individuals, (2) to know the community, and (3) to know what facilities are available for organizing the program.

To know the pupils or individuals is very important since it is for them that we wish to organize a guidance program. We wish to know their needs, interests, and abilities. This information may be obtained, to a great extent, by testing, oral examinations, and by actual contact through conferences, and the like. Information about pupils should be kept on some sort of record.

There are any number of records that can be used. Probably the best is some type of cumulative record which is kept in a folder. This type of record has many advantages. Besides routine information gathered about pupils, we may place incidents of pupils, letters, etc., in the folder.

Records and files should be kept accurately, and should be accessible to the counselors or others who are in charge of guidance. Testing of pupils should be done by individuals such as teachers who are especially trained to do this, or by outside experts such as individuals who are associated with research or testing bureaus. The tests should be purely objective and of such nature that they reveal certain definite facts that are necessary to know about an individual before a good program of guidance and adequate counseling can be carried on.

To know the community is indeed an important essential of a good guidance program. It has been found that a much larger percentage of individuals living in a certain community or locality remain there the rest of their lives than individuals who go elsewhere. Therefore, in guiding individuals, we wish to know what the community has to offer and what the possibilities are in the future.

In order to know the community, it is necessary to make a community survey. This survey should indicate clearly the mobility and type of population found there, the characteristics of the community — whether urban, rural, industrial — and the types and kinds of jobs found there.

This survey may be carried on by questionnaires, and by actual contact or interview with those concerned. Probably the most effective procedure to use would be the two methods, each one supplementing the other. Then there must be a compiling and interpreting of the data received from the survey. Such information should also be accessible to individuals who will do the counseling, and individuals who are concerned with organizing a functioning guidance program.

Equally as important as any other essential of a guidance program is to know what facilities are available for organizing the program. By this, we do not necessarily mean equipment, although this is important. We are interested in knowing what agencies are available to contribute to the success of the programs, what individuals will be interested enough to give of their time and services, how well the teachers are trained to participate in such a program.

When counseling is necessary, a room comfortable in all respects and conducive to good counseling and interview should be provided. This would naturally involve the equipping of such a room, if it is not in existence already.

From time to time, it will be necessary to use some individuals especially trained in a particular field to talk with pupils. These individuals must be willing to give of their time and services for such a worthy cause.

*Sumner High School, St. Louis, Mo.

Agencies and clubs in the city, such as welfare agencies, YMCA, YWCA, and other youth organizations will generally be most willing to cooperate with a program, and give of their time and services in helping in any way possible toward the securing of certain information, contributing with both work and publicity to the program.

In the final analysis, every teacher is a counselor, and is most influential in the guiding and the directing of individuals he or she comes in contact with each day. To the teacher, guidance is not new. They have realized the importance of it and have known full well that their time has been so taken up with duties that they have had little time for the job of guiding and directing. Therefore, they are aware of the need for organizing a program with a purpose — a functioning guidance program. These teachers, of necessity, should also possess certain definite training which will enable them to contribute to the building and development of a program that is both workable and effective.

In the organizing of a functioning guidance program, we must not fail to see the importance of basic essentials, which if carried out together with a thoroughly organized plan will bear fruits, and, of course, be influential in the lives of our children — the men and women of tomorrow, who will contribute to the citizenship of our democracy.

A Comprehensive Filing System for the General Shop

ROGER I. PARKE*

Very early in his teaching career the teacher of a general shop realizes the need for a system of filing instructional materials. This material generally consists of folders, charts, pictures, catalogs, descriptions of projects to be made, outlines, correspondence, and the like. There is an urgent need for saving and using materials which have not as yet been put into book form because industrial-arts subjects are continually changing, and because new types of materials are rapidly replacing conventional materials. A filing cabinet system therefore becomes indispensable.

Fig. 1. A useful file

This article suggests how administrative and instructional materials may be filed either in a standardized sectional cabinet or in cabinets constructed in the school shop. The type of cabinet preferred by the writer is shown in Figure 1.

The project-card file. Drawer 2 is used as the project-card file. The picture, drawing, and directions for making each project are mounted on 9 by 12-in. manila cards or in manila folders of the same size. The card is customarily used if all directions for the project are on one side of the paper. If the directions are on both sides of the paper, it has been found advisable to hinge the sheet inside the manila folder by means of cellulose tape. The folder also is required when patterns are essential to the construction of the project.

Source of projects. Current magazines furnish an inexhaustible supply of project materials. Magazines such as the following are excellent sources: INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, *Popular Homecraft, Popular Mechanics, Popular Science, Industrial Education, Home Craftsman, Model Craftsman, Inland Printer, Hobbies, American Builder, American Photography, Architectural Forum, The School Arts, Automobile Digest, Better Homes and Gardens, Electrical Engineer, Model Airplane News, Modern Mechanix,* and the *Model Builder.*

Original designs made by teachers and students can be drawn directly on the 9 by 12-in. manila cards or drawn on other paper and mounted on these cards.

Textbooks, supplementary books, and workbooks provide still another source of material for projects. If old books — about to be discarded — are available, the most valuable projects may be selected from these, mounted, and filed.

Criteria for selection. Obviously, criteria for the selection of projects worthy of mounting must be determined by local needs and conditions. Generally factors such as the following are considered: (*a*) facility for making the project with the shop equipment on hand, (*b*) difficulty of operations involved with respect to the ability of students to perform them, (*c*) practicability of the project for the particular locality in which it is to be used, (*d*) cost involved, and (*e*) clarity and accuracy of the plan presented.

System of Numbering and Filing:

A simple system. A simple system for arranging cards in a file may be worked out by establishing the main headings desired and arranging them in alphabetical order thus:

Basketry	Concrete work
Birchbark work	Feltwork
Bookbinding	Finishing
Brickwork	Indiancraft
Carving	Jewelry
Leatherwork	Upholstery
Machinery	Waxwork
Mechanics	Weaving
Photography	Whittling
Plastics	Woodwork
Printing	Wrought iron
Sheet metal	

Project card may then be filed in alphabetical order in back of each of these headings. Care must be taken in noting subject headings as well as project names at the top of the card so as to facilitate refiling after the card is removed from the file as: See Figure 2.

```
Woodwork.

  Bookcase - (colonial wall)
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Fig. 2. A project card

An adaptation of the Dewey Decimal System. A more elaborate system must be used if cards are to be numbered and found quickly and if provision is to be made for indefinite expansion of the file. The writer has found the following plan to be most helpful. Cards are numbered from 0 to 1000 according to the following major categories:

Card number in terms of hundreds	*Division of industrial-arts work to which it refers*
0– 99	Woodwork
100–199	General metal
200–299	Electricity
300–399	Leatherwork
400–499	Plastics
500–599	Printing and bookbinding
600–699	Photography
700–799	Textiles
800–899	Clay, glass, masonry, brickwork, concrete
900–999	Miscellaneous: birchbark work, carving, felt, finishing, Indiancraft, rush, basketry, whittling, wax, weaving, upholstery, etc.

*High School, Spring Valley, N. Y.

This classification determines the number of hundreds recorded on the card. The following classification considers activities in construction and manufacturing in the field of industrial arts and determines the number of tens that will appear in the final figure:

0– 9	Building and building accessories
10–19	Furnishings
20–29	Furniture
30–39	Wearing apparel
40–49	Toys, games, apparatus for recreational purposes
50–59	Transportation
60–69	Communication
70–79	Production of heat, light, power
80–89	Workshop and school equipment
90–99	Model making

What the unit column of the number will be is dependent on subdivisions found in the tens column. The key follows:

0– 9 Buildings
0, homes; 1, apartment houses; 2, barns; 3, garages; 4, business establishments; 5, greenhouses; 6, birdhouses; 7, poultry houses; 8, animal and insect houses; 9, accessories to buildings as: fences, walks, trellises, birdbaths, swimming pools, gardens, totem poles, screens, awnings, ventilators, hardware, etc.

10–19 Furnishings and equipment
10, baking and cooking utensils; 11, dishes; 12, tableware; 13, cleaning equipment; 14, washing and ironing equipment; 15, curtains, drapes, rods; 16, bric-a-brac and accessories; 17, smoking accessories; 18, recreational and camping equipment; 19, laboratory equipment

20–29 Furniture
20, chests, bureaus; 21, chairs and footstools; 22, tables and tea wagons; 23, sofas and beds; 24, mirrors, picture frames, inlaid pictures; 25, racks and cabinets; 26, musical instruments; 27, lamps; 28, clocks

30–39 Wearing apparel
30, jewelry; 31, dresses, shirts, underwear; 32, suits; 33, hats; 34, shoes; 35, coats; 36, hose; 37, gloves; 38, ties and scarfs; 39, accessories as: handbags, belts, key cases

40–49 Toys and games
40, dolls; 41, animals, insects; 42, transportation vehicles as trains, engines, airplanes, autos, ships, boats, wagons, etc.; 43, commercial and communication instruments as: banks, store equipment, telephone, telegraph; 44, tools, machines and electric apparatus; 45, puppets, theaters; 46, buildings; 47, furniture and furnishings; 48, indoor games; 49, outdoor games

50–59 Transportation
50, streets and highways; 51, bridges; 52, power vehicles; 53, water vehicles; 54, bicycles; 55, animal-drawn vehicles; 56, sleighs, bobsleds, etc.; 57, air transportation; 58, trains; 59, trolleys, subways

60–69 Communication
60, telephone; 61, telegraph; 62, cablegraph; 63, wireless; 64, radio; 65, newspapers; 66, magazines; 67, television; 68, electric signs; 69, bells

70–79 Production of heat, light, power
70, generators, dynamos; 71, motors; 72, testers; 73, engines

80–89 School workshop
80, layouts; 81, workbenches; 82, machinery construction; 83, tool construction; 84, patternmaking; 85, display and care of tools; 86, tables; 87, cabinets and lockers; 88, drawing equipment; 89, miscellaneous

90–99 Model making
90, furniture; 91, furnishings; 92, tools and machines; 93, communication instruments; 94, transportation vehicles; 95, buildings and accessories; 96, bridges and roads; 97, transmission of heat, light, and power; 98, persons and animals; 99, wearing apparel

A finer classification by tens and hundreds can then be made if desired. For instance, a table made of wood would be numbered 22. If it were made of metal, it would be 122. Types of tables can be indicated thus:

	Wood	*Metal*
Dressing table	22.0	122.0
Dining-room table	22.1	122.1
Nest of tables	22.2	122.2
Coffee table	22.3	122.3
Serving table	22.4	122.4
End table	22.5	122.5
Tilt-top table	22.6	122.6
Card or bridge table	22.7	122.7
Garden or lawn table	22.8	122.8
Occasional table	22.9	122.9

A further classification can be made as follows: Thus the end table (22.50) may be listed as:

Plain	22.50
With shelves	22.51
With rack for books	22.52
Modernistic	22.53

Project cards are filed back of heading cards as indicated for hundreds and tens columns. All project cards for woodworking are thus filed together, as are all cards for electricity and the other main headings. If a card is taken out it is easily replaced by number.

The Card Catalogue

Drawers 1A and 1B contain 3 by 5-in. cards on which project card titles are listed. These are alphabetically arranged under (*a*) woodworking, (*b*) metalwork, (*c*) electricity, (*d*) leatherwork, (*e*) plastics, (*f*) printing and bookbinding, (*g*) photography, (*h*) textiles, (*i*) clay, glass, masonry, brickwork, concrete, (*j*) miscellaneous. To take care of any expansion, drawers 1C and 1D may be used. In the writer's file on woodwork, for instance, the following cards may be found under A:

Airplane — solid with cabin	94.31
Airplane — solid biplane	94.32
Airplane — propeller carving	94.37
Arbor — rose	9.2
Archery — arrows	49.2
Archery — flat bow	49.4
Auto — toy	42.37
Ash tray	17.5

File of Operations, Processes, and Related Material

Drawer 3 can be used to file any valuable materials in reference to operations, processes, and related material. They can be readily found when filed alphabetically under the following categories:

Basketry	Mechanics — home, airplane, auto
Birchbark work	Metalwork — copper, brass, gold, silver, pewter
Bookbinding	Patternmaking
Carving	Photography
Ceramics	Plastics
Cement	Printing
Design	Ropework
Electricity	Rush work
Feltwork	Sheet-metal work
Finishing	Textiles
Foundry (castings)	Upholstery
Indiancraft	Weaving (see textiles)
Inlays — marquetry	Welding
Glass	Whittling
Leatherwork	Woodwork
Machine-shop practice	Wrought iron
Masonry	
Mechanical drawing	

Administrative and general file. Drawer 4 in the writer's file contains the following headings:

Assemblies
Bibliographies
Bulletin board materials
Bulletins: State Department
American Vocational Association
Local meetings of industrial-arts organizations
School
Business: Accounts, orders, inventories, estimates of costs
Catalogs
Clubs
Courses of study
Equipment and supplies
Home-room activities
Hobbies
Layouts (shop)
Marking system
Personal
Tests
Theory — objectives and trends
Regents credit requirements
Safety
Shop management
Visual education
Vocational guidance

Other folders may be added as the need for them arises. Some of the foregoing topics may be broken down into subdivisions as quantities of material become available.

"Because of the changing nature and increasing complexity of the industrial picture it seems justified to suggest that '75 per cent of the learning period in a vocational school should be devoted to breadth and versatility in trades rather closely allied, with the remaining 25 per cent given to intensive preparation for the initial job.' Even some expert craftsmen may need to return to our vocational schools for something now thought of as industrial arts, as protection against unemployment." — *Homer J. Smith.*

He that is of opinion money will do everything may well be suspected of doing everything for money. — *Benjamin Franklin.*

OBJECTIVE GRAPHIC-ARTS EXAMINATION

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Directions: In each of the following groups of words there are five lines of words. Three of these lines pertain to a single aspect of the graphic arts.

Examine each group, decide what it is that three of the lines have in common, then cross out the two lines that do not relate to the same idea.

Example: pica, point, ~~font~~, em, ~~rule~~. Pica, point, and em refer to units of measure of type. Font and rule are not similar measures so are crossed out.

1	2	3	4
stone	quarto	mimeograph	Kelly
router	folio	hectograph	Chandler and Price
case	caption	silk screen	Victoray
quoin	tympan	stencil	Big Chief 29
planer	octavo	multigraph	Miehle

5	6	7	8
logotype	imprint	W. Dwiggins	Golden Hind
electrotype	serif	P. Didot	Woolly Whale
stereotype	script	R. Polk	Golden Cockerell
nickeltype	feet	F. Goudy	Sphinx
ambrotype	groove	L. Bernhard	Centaur

9	10	11	12
shoulder	pica	McMurtrie	*Inland Printer*
signature	long primer	Chamberlain	*American Institute of Graphic Arts*
end sheet	reglet	Pennell	*United Typothetae*
head	pallet	Whistler	*American Printer*
bookplate	brevier	Gutenberg	*Graphic Arts Monthly*

13	14	15	16
B. Franklin	font	T'sai Lun	vatman
W. Bradford	pi	Dard Hunter	compositor
C. Sweynheym	fount	Wm. Rittenhouse	coucher
C. Sauer	web	Richard Pynson	ascender
A. Newton	sorts	Will Ransom	layman

17	18	19	20
Nash	platen	Henry Huntington	stick
American	bed	T. J. Cobden-Sanderson	ream
Continental	gripper	Bruce Rogers	counter
Nuremberg	knee	W. A. Dwiggins	quire
Bauer	Hollander	C. P. Rollins	post

21	22	23	24
Fourdrinier	Cheltenham	English finish	Macmillan
Jordan	Gill	half stock	McGraw-Hill
chiascuro	Johnson	half tone	Bruce
beater	Hewitt	Ben Day	Sigmund-Ullman
ampersand	Cruikshank	process plate	Lanston

25	26	27	28
D. Updike	gauge pins	cerotype	Merrymount Press
T. DeVinne	line gauge	photostat	Grabhorn Press
W. Kittredge	deckle	aquatint	Spiral Press
E. Gress	tympan	mezzotint	Intaglio Press
A. Koberger	bale	dry point	Washington and Hoe Press

29	30	31	32
planography	super	daguerreotype	lead
rotogravure	linen thread	collotype	tin
photogravure	block book	offset	aluminum
xylography	make-ready	lithograph	antimony
embossing	headband	steel engraving	zinc

33	34	35	36
L. Cranach	monotype	Centaur	Mergenthaler
W. Caslon	frisket	Cloister	Chandler and Price
Stephen Day	linotype	Kabel	Colt
J. Baskerville	photolith	Bodoni	Grolier
N. Jensen	Ludlow	Garamond	Golding

37	38	39	40
Cartoon	Walker	folio	Kelmscott
Legend	Lankes	ream	Doves
Donatus	Watson	quire	Ashendene
Hobo	Nason	leader	Senefelder
Trafton	Pyle	bundle	Blake

41	42	43	44
deckle edge	Cole	linseed oil	paleography
fore edge	Didot	resin	parchment
chain line	Bell	lampblack	pencil
mold	Bewick	carborundum	papyrus
watermark	Doré	gelatin	paper

Key

Common factor in each group, and unrelated items that should be crossed out:

1. Imposing equipment
   router
   case
2. Sizes of books or folds of signatures
   caption
   tympan
3. Stencil processes
   hectograph
   multigraph
4. Makes of presses (letterpress)
   Victoray
   Big Chief 29
5. Duplicating processes
   logotype
   ambrotype
6. Parts of a piece of type
   imprint
   script
7. Contemporary type designers
   Didot
   Polk
8. Modern private presses
   Sphinx
   Centaur
9. Parts of a book
   shoulder
   bookplate
10. Old names for type sizes
    reglet
    pallet
11. Modern etchers
    McMurtrie
    Gutenberg
12. Typographic magazines
    American Institute of Graphic Arts
    United Typothetae
13. Early Pennsylvania printers
    C. Sweynheym
    A. Newton
14. Measures of type quantity
    pi
    web
15. Papermakers
    Pynsom
    Ransom
16. Occupations in making paper by hand
    compositor
    ascender
17. Type foundries
    Nuremberg
    Nash
18. Parts of platen press
    knee
    Hollander

    Measures of paper
    stick
    counter
19. Modern American book designers
    Huntington
    Cobden-Sanderson
21. Machines used in papermaking
    chiascuro
    ampersand
22. English calligraphers
    Cheltenham
    Cruikshank
23. Photoengraved plates
    English finish
    half stock
24. American Publishers
    Sigmund-Ullman
    Lanston

25. American authors on typography
Kittredge
Koberger

26. Furnishings for platen
line gauge
deckle

27. Intaglio processes (autographic)
cerotype
photostat

28. Well-known American presses
intaglio press
Washington and Hoe

29. Intaglio processes (machine)
planography
xylography

30. Bookbinding materials
block book
make-ready

31. Planographic processes
daguerreotype
steel engraving

32. Metals in type metal
aluminum
zinc

33. Early type designers
Cranach
Day

34. Composing machines
frisket
photolith

35. Modern sans serif types
Centaur
Garamond

36. Job presses
Mergenthaler
Grolier

37. Modern cursive letters
Donatus
Hobo

38. American block-print makers
Walker
Pyle

39. Measures of paper quantity
folio
leader

40. Famous English private presses
Senefelder
Blake

41. Characteristics of paper due to manufacture
fore edge
mold

42. Wood engravers
Didot
Bell

43. Ingredients in printer's ink
carborundum
gelatin

44. Writing materials
pencil
paleography

Problems and Projects

ORNAMENTAL TIN CRAFT

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(*Continued from page 158 of the April, 1944, issue*)

Letter Opener

A letter opener is an excellent beginning problem. It is a relatively small but practical project, and in it the novice will work out many of the elementary and basic operations so necessary to the successful constructing or designing of the more advanced items which make up a complete desk set. When this clever opener is completed, the beginner will readily understand the many possibilities which sheet tin-can craft offers him.

The sheet of designs given here are only a few of the many suggested arrangements. Ingenuity and interest will govern the patterns and designs which can be developed. Once a general style for design is decided upon, all remaining pieces of this set should be matched. The handle of the letter opener may have additional pieces soldered on, as shown in design A, or it may be pierced as shown in the remaining patterns. Should the size not be satisfactory, it may also be changed to suit even the most varied taste.

Since the letter opener is the first problem, considerable care must be taken to secure a well sweat-soldered joint in joining the two pieces of sheet tin. After cutting the outline of the knife it might be necessary to resolder the edge to cover any opening which might result from sweat-soldering.

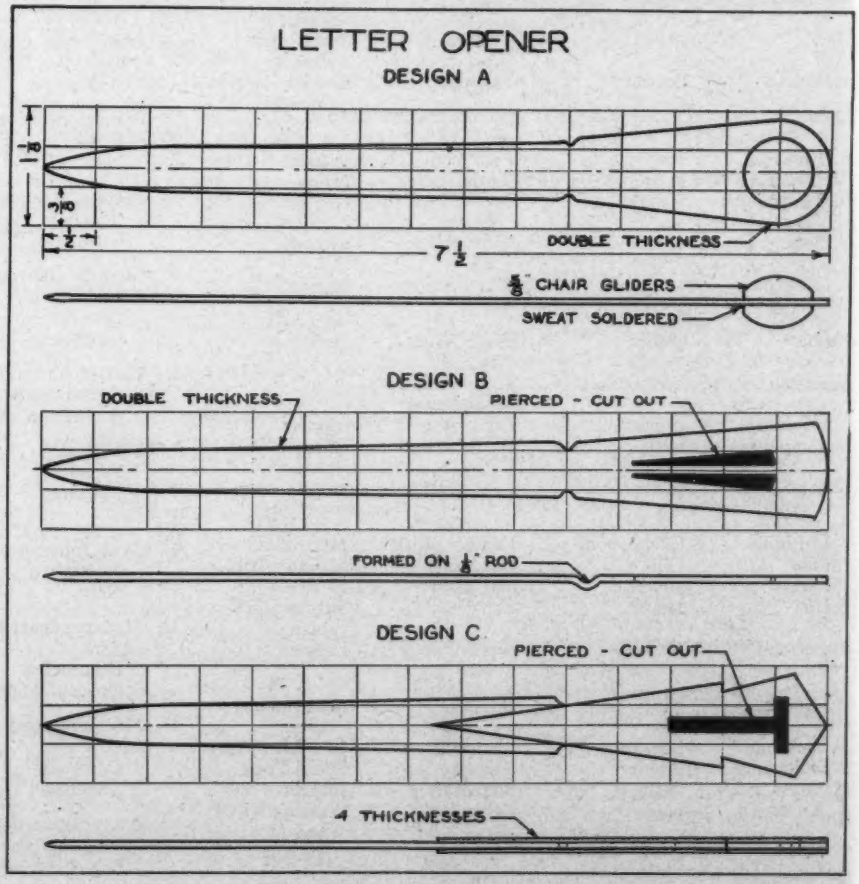
The copperplating procedure is one that intrigues the craftsman because it shows how plating changes the entire complexion of tin plate to one of rich shiny copper. It is necessary to clean the plating with No. 2/0 steel wool very thoroughly to a bright polish. Handle the project with cloth so that finger marks will not appear. This precaution is necessary since prints tend to tarnish the surface even after the lacquer has been applied. The lacquer should be applied with a spray or brush immediately after polishing. When it is dry, the project is ready for use.

Materials. Material needed for letter opener shown in design *A:* 2 pieces of tin 1½ by 8 in.; 2 — ⅝-in. chair gliders; solder, flux, and steel wool.

Tools and Equipment. Alcohol torch or lamp, asbestos sheet, brush, carbon paper, copperplating equipment, emery cloth, file, flat iron, heating device, jeweler's frame and blade, lead or wood block, peening hammer, pencil, rule, scriber, soldering copper, tempera water-color paint (yellow), tin snips, and weight.

Procedure:

1. Draw design as shown at *A, B,* or *C,* in the illustration, or develop an original design.
2. Cut out 2 pieces of tin stock.



3. Solder one side of each piece.
4. Sweat both pieces together with hot flat iron. Weight the soldered parts immediately as more is sweated together.
5. Apply coat of yellow tempera water-color paint to one side of sweated piece for design transfer.
6. Lay design sheet and carbon paper over painted portion and trace design.
7. Cut out letter opener with tin snips.
8. File and dress edges with emery cloth.
9. Drill hole and pierce if design calls for it.
10. Peen surfaces on lead or wood block.
11. Remove prongs from chair gliders, file edges.
12. Apply solder on edge of gliders. Sweat-solder gliders in place with alcohol torch.
13. Rub the knife with steel wool and prepare for plating.
14. Apply thick plating of copper.
15. Polish project with steel wool. Do not touch metal with hands.
16. Apply coat of clear metal lacquer and allow to dry.

Pencil Tray

The design of the pencil tray, as shown, is very simple, yet matches the general pattern of the other pieces that will make up the desk set. The pencil tray has been chosen as the second project to be executed by the beginner because it embodies the same simple operations used in the construction of the letter opener plus some bending. After completing this attractive object, one can understand how easily double thickness sheet tin plate works into the many novel pieces.

Two designs of the pencil tray are shown in the illustration. The variations in the two designs merely indicate how patterns may be changed to suit the taste of the individual craftsman. It is suggested that a general design be adopted before making the first project and then used as the main theme for all pieces of the desk set in order to have a matched group.

The letters in design B may be pierced or overlaid. If they are overlaid, they should not be peened in order to show a contrast against the remainder of the project which has a peened surface. Again the size of this project may be altered to fit the ideas of the designer.

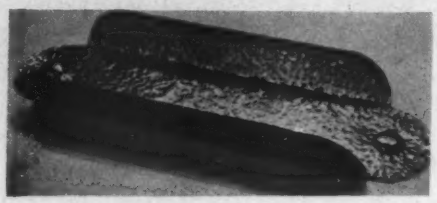
After the two pieces of tin plate, forming the body of the tray, have been sweat-soldered, the tray may be cut out with the tin snips. It may be necessary to resolder the edges if any opening should develop between the sheets.

Materials. Materials needed for the pencil tray are: 2 pieces of tin 4½ by 8½ in.; 2 — ⅝-in. chair gliders; solder, flux, and steel wool.

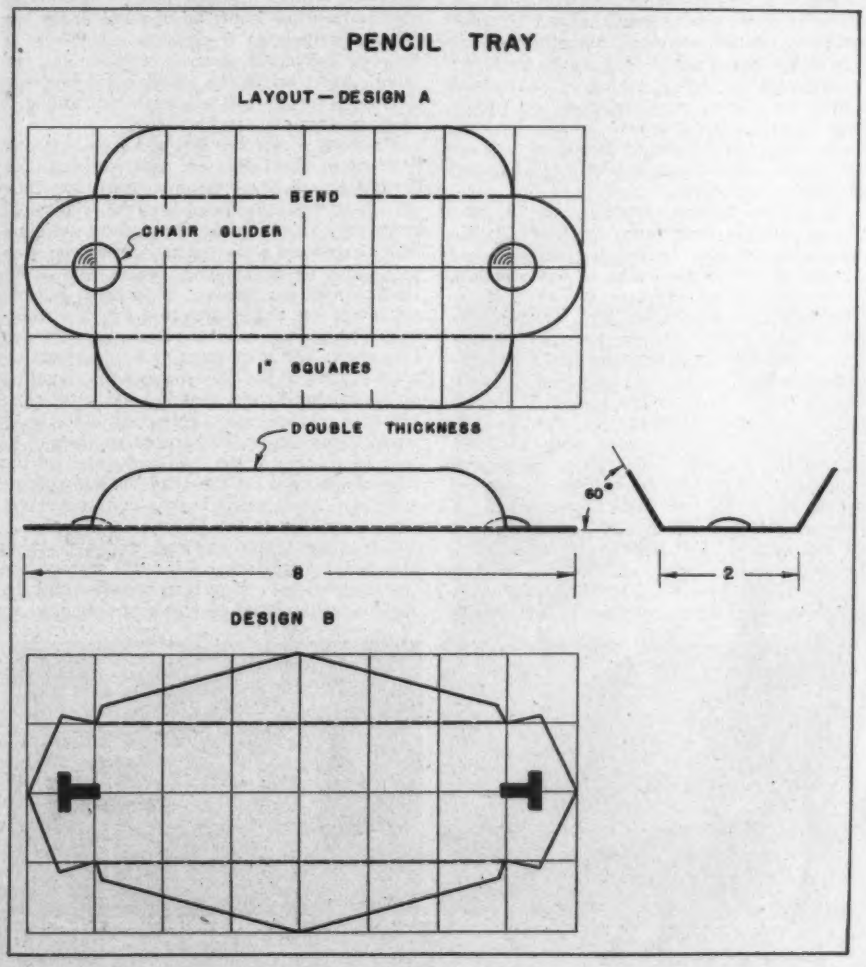
Tools and Equipment. Alcohol torch or lamp, asbestos sheet, brush, carbon paper, copperplating equipment, emery cloth, file, flat iron, heating device, lead or wood block, lead weight, peening hammer, pencil, rule, scriber, soldering copper, tempera water-color paint (yellow), and tin snips.

Procedure:

1. Draw design as shown at *A* and *B*, in the illustration, or develop an original design.
2. Cut out 2 pieces of tin stock.
3. Solder one side of each piece.
4. Seat both pieces together with hot flat iron. Weight the soldered parts immediately as more is sweated together.
5. Apply coat of yellow tempera water-color paint to one side of sweated piece for design transfer.
6. Lay design sheet and carbon paper over painted portion and trace design.
7. Cut out pencil tray with tin snips.
8. File and dress edges with emery cloth.
9. Drill hole and pierce if design calls for it.
10. Peen surfaces on lead or wood block.
11. Remove prongs from chair gliders, file edges.
12. Solder edges on gliders.
13. Sweat-solder gliders in place with alcohol torch.
14. Bend and form as indicated in illustrations.
15. Rub the tray with steel wool to prepare for plating.
16. Apply thick plating of copper.
17. Polish project with steel wool. Do not touch metal with hands.
18. Apply coat of clear metal lacquer and allow to dry.



Pencil tray



PLASTIC SWITCH PLATE

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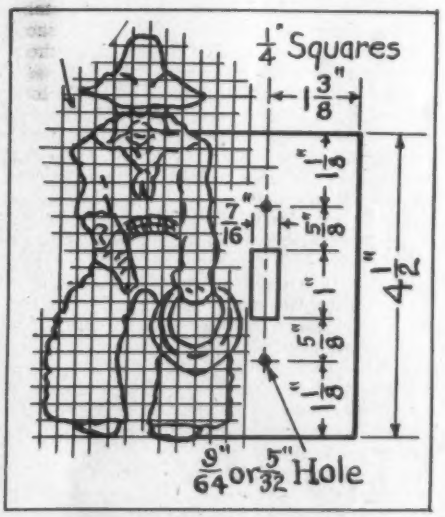
In making a plastic switch plate of the type shown, it is first necessary to select a design that will look well in a given room or place. The design is then traced or copied on a piece of plastic sheet that is about ⅛ or



Suggested design for a plastic switch plate

3/16 in. thick. It is necessary then to go over the traced lines with a scratch awl or scriber, making the lines about 1/32 in. deep.

After the plate is cut, filed, drilled, and polished in the usual manner, the scraped lines are filled in with lacquer or an attractively colored printing ink. After the lacquer or ink has dried, the result will be a very practical and beautiful switch plate.

The beauty and variety of designs which can be used for making these plates is limited only by the ingenuity of the pupil and of the instructor. Plastics from old serving trays may be used. However, plywood or fiberboard may serve as substitutes if plastics cannot be obtained.

A WAR GARDEN TRACTOR

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The demands of our war effort in the production of food has again focused considerable interest on a shop project which has proved very worth while in the past 8 or 10 years. Farmers, victory garden clubs, 4H clubs, and FFA chapters are more interested than ever in an economical source of primary or auxiliary power for their various hauling projects.

To meet this need we have developed a "homemade" tractor which may be assembled from used car and truck parts available in scrap metal collections or at the many junk yards at a nominal price.

Many of these tractors have been assembled by individual farmers, garage mechanics, general "handy men," and by classes in vocational agriculture where the shop facilities available were adequate to promote such a project. Upon completion they have not been restricted to agricultural purposes, but have been observed in operation as snowplows in gasoline stations, tow trucks in garages, wreck handlers and general haulers in junk yards, and with a 2-wheel trailer as log haulers in lumberyards. Their agricultural uses are too numerous to mention specifically, but in general they will supplant one pair of horses on the large farm, and on many small farms they are the only source of power. Owing to the shortage of man and horse labor, some victory garden clubs might find a cooperative shop enterprise of this kind the answer to their plowing and tillage problems.

The implements with which these tractors are used are generally secondhand, and originally intended to be horse drawn. This tractor, however, does an excellent job of plowing with a regular 16-in. single bottom tractor plow on heavy clay sod land. This will serve to give some idea of the power limitations.

Three general principles have guided us in the building of this tractor. They are (1) economy; (2) simplicity; and (3) adaptability.

Economy: It is evident that the tractor must be cheap to build, or else it would automatically defeat its own most powerful recommendation. Further than this, it must be so built that economy will be maintained over a period of years and be reflected in low operating and maintenance costs. It is well, then, to select an engine in a fairly good state of repair, and especially important that it be equipped with a radiator and water pump of sufficient capacity to prevent the engine overheating under the more severe demands of tractor operation. The engine should be

Fig. 1

thoroughly checked to be certain that all bearings are in good condition, pistons properly fitting in the cylinders with plenty of life in the piston rings. Head, block, and valves should be in good condition with a good snappy valve spring action. The oil pump screen and filter should be removed and cleaned.

The carburetion and ignition system should be cleaned and adjusted and all compression and oil leaks should be stopped by new gaskets. Remove the starting motor and generator, clean them and turn down the commutators in the lathe if necessary.

Don't hesitate to use an engine that is noted for being a "gas hog." You will find that a heavy motor that took an excess of fuel to propel an automobile will generally just idle along cooly and smoothly for tractor operation. As the most efficient carburetion occurs at these near idling speeds, an actual saving of fuel will be noticed in comparison to the lighter motor which would have to work harder to do the same job. A further advantage of the heavy motor is that it is generally mounted on a chassis which is substantial enough for tractor work and equipped with a large capacity cooling system. In addition they are no longer in demand as passenger cars and can usually be purchased at a small fraction of their actual value.

As it is sometimes economical in the long run to spend a little more for parts, in the purchasing of your second transmission and differential it is a good plan to buy standard parts made by reliable manufacturers. If replacement of gears or bearings becomes necessary later, they can be more readily procured, and usually at less expense, either new or secondhand.

Simplicity: The tractor is simple enough in construction so that any mechanic or mechanically minded person with the necessary tool equipment can follow the general recommendations and adapt them to the materials which he may have. For the sake of simplicity it is not equipped with a governor or a pulley, though both would be desirable additions and might be added later at comparatively little expense. Under dusty conditions vacuum tanks may give considerable trouble due to clogging so we use a gravity feed from the tank to the carburetor. There is no drive shaft, as such, the second transmission substituting in place of it.

Adaptability: The tractor is readily adaptable, both for comparatively high road speeds and heavy pulling jobs on the farm with a range of gear selections that permit a combination of both speed and power to handle any type of work within its natural capacity. For this maximum adaptability it is equipped with a second transmission between the regular car transmission and the truck differential. It has pneumatic truck tires, an adequate braking and lighting system, and a self-starter which is a tremendous advantage in getting those little odd jobs done which might not be done if the tractor had to be started manually. It has a small plank platform over the differential which is just the right height to drive fence posts from or rush that extra bag of seed or fertilizer from the barn to the fields. It has a maximum road speed of approximately 40 m.p.h. and a peak draw bar horsepower equal to the conventional two-plow tractor.

The car selected for this project was a 1922 Peerless. The motor is of the V-8 type and has a built-in air compressor which is handy for pumping up all the tires on the farm. The frame is the usual channel iron type and is further strengthened by a truss rod from front to rear underneath each side member. See Figures 1 to 6. The heavy motor develops sufficient horsepower so that the occasional extra heavy job can be handled efficiently, and it has enough weight to successfully overcome the torque leverage which has a tendency to raise the front end of a lighter tractor off the ground. As a pleasure car it was a *gas hog* delivering about 8 to 12 miles per gallon. As a tractor the gasoline consumption is only 1 to 1½ gallons per hour hauling a 14-in. bottom plow in heavy sod.

The body of the Peerless was sawed off just in front of the front seat and removed. See Figures 1 to 4. Each running board was then cut off at this same point and the windshield removed. This method leaves the original floor boards and a short running board on each side. The entire running boards and front fenders may be removed if desired, but no advantage has been discovered for this procedure except better front-wheel visibility for the driver. The advantages of leaving them on are: (1) they provide convenient mounting places for headlights, toolbox, and spare tire; (2) bags of feed, posts, poles, and other occasional items can be transported on them; (3) they keep some of the mud and water off the operator if used on the road on rainy days; and (4) the running boards are convenient when mounting to the driver's seat.

The drive shaft, rear end, and everything attached to the frame from the rear of the transmission back were then removed and the car frame supported on a pair of sawhorses.

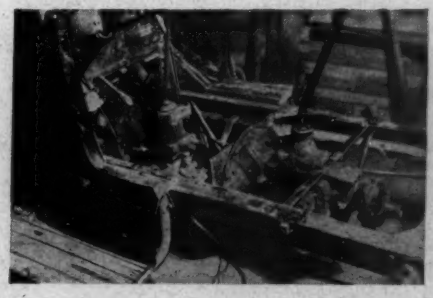


Fig. 2

Fig. 3

Fig. 4

The second transmission which was used for this project was a 4-speed truck transmission out of a heavy duty International truck. This transmission was swung into place behind the Peerless transmission with a set of portable chain falls and connected to the Peerless transmission by means of the Spicer Universal Joint which was original equipment on the car. The length of this universal joint brought the face of the truck bell housing (the housing that originally enclosed the truck clutch) ½ in. to the rear of a frame cross member located at this point. A steel plate ½ in. thick and 6 in. wide, long enough to cover the face of the housing, was then inserted between it and the frame cross member. This plate had a piece of 1¼ in. by 1¼-in. angle iron previously welded along the long side and adjacent to the edge in such a manner that the angle iron rested on the frame cross member thus supporting the ½ in. by 6-in. plate vertically in the correct position for the bell housing to be bolted to it. This assembly of angle iron and plate were then welded to the frame cross member. If there is no cross member in this location on your car, a 3 by 5-in. angle iron can be welded in place of it. See Figures 1 and 3.

By laying a straightedge across the frame just above the rear of the Peerless transmission the measurement down to the drive shaft was determined and the truck transmission was then brought into the vertical alignment where the two measurements were identical. The center of the truck transmission was then moved horizontally into line with the center of the frame cross member and clamped rigidly in this position. The bell housing was then bolted to the plate by 2 7/16-in. bolts on each side, using the holes already in the housing and drilling the plate with a portable electric drill. As the bell housing holes in the original truck installation are centered at the offset where the inner and outer faces join, it is necessary to insert washers between the housing and the plate to give a flush bearing surface between housing and plate. Without these washers there is some probability that the cast-iron housing would be cracked when tightening the bolts, or later under torque stress in operation.

Another ½ by 6-in. plate was bolted to the housing below the universal joint and from this plate a ½ by 1¼-in. iron brace was run on each side to a point on the main frame 15 in. ahead of the cross member supporting the bell housing. A short lateral brace was also welded from the midpoint of the main brace to the frame. See Figures 2, 3, and 5.

A piece of ¾-in. round bar iron was threaded on each end and forged to shape to make a sling support under the rear end of the truck transmission. This was installed with the center at red heat and the ends drawn through holes drilled in the main frame by nuts on heavy washers on the outside of the frame. It was then spot-welded at each end of the sling to the frame to prevent change in this vertical alignment, as shown in Figure 6.

A piece of ⅜ by 1¼-in. iron was used as a frame cross member above this sling, bolted at each end to the frame and in the middle to the top of the transmission case by removing two of the cap screws holding the cover and substituting two cap screws ⅜ in. longer than the originals and extending them through the ⅜-in. iron. See Figure 6. This type of installation for the second transmission prevents the extra strain which is thrown on the universal joints by a less rigid system of suspension. A further advantage is in the fact that the transmissions can be unbolted and removed if necessary for repairs in the future.

The differential used on this project is a Timken, from a heavy duty, high-speed tractor-trailer type truck. It is equipped with standard 20-in. Budd wheels and standard 8:25 by 20 truck tires. It can be used with single or dual wheels and a tread adjustment of several inches can be obtained by using single wheels and facing the dish in or out as may be desired.

This differential was wheeled into place under the car frame, and the sawhorses removed allowing the frame to rest on the axle housing. It was connected into the rear end of the truck transmission by means of the heavy *mechanics universal* joint which was original equipment on the differential. This brought the differential housing just to the rear of a frame cross member which was located at this point. If your car does not have a cross member located at this point, a 3 by 5-in. angle iron may be welded in as suggested previously. The center of this cross member was then marked as was the central point on the differential housing and the two marks brought into alignment. The differential housing was then clamped to the frame cross member to preserve this alignment. The wheels were then rolled slightly ahead or backward until the point at which the frame rested on the axle housing was equi-distant from the rear end of the frame on both sides. The wheels were then securely blocked front and rear to preserve this alignment.

To attach the frame to the differential, a piece of 3½ by 5-in. heavy angle iron, ½ in.

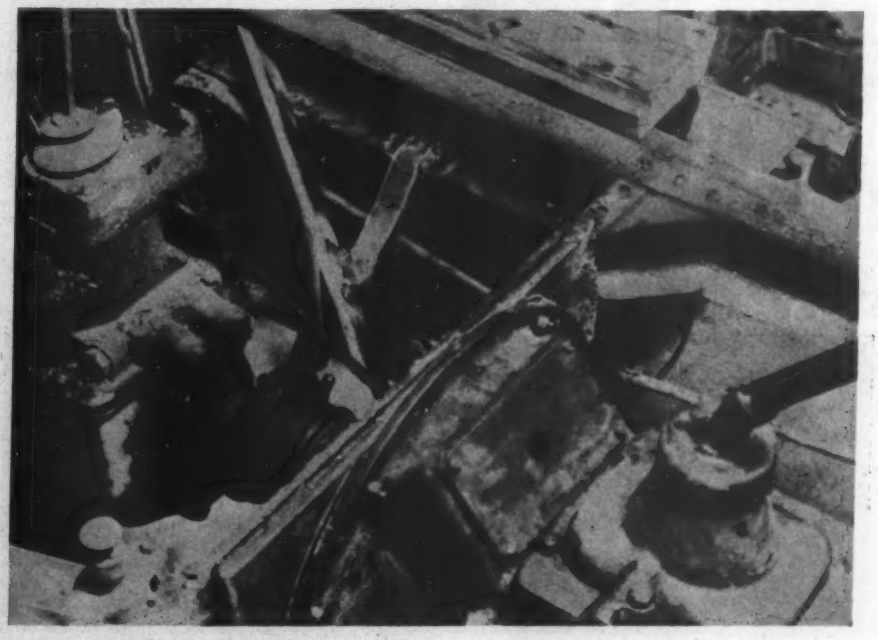


Fig. 5

Fig. 6

thick and 16 in. long, was laid on the spring block of the axle housings in such a manner that the 3½-in. side was parallel to, and in contact with, the vertical outside of the frame channel. Thus the 5-in. side of the angle extended over, and was in contact with, the spring block of the axle housing. The holes to be drilled for the ¾-in. bolts which would attach the angle irons to the spring blocks were then marked out and the angle iron removed and drilled at these points on a drill press. The angle irons for both sides were prepared in this manner, then replaced and bolted to the axle housings with four ¾ by 8-in. machine bolts on each side which connected them with the lower halves of the spring clamps, or saddle blocks which were original equipment under the axle housings. All alignments were then rechecked, the angle irons clamped to the frame and then welded to same. See Figure 4.

A piece of ½-in. round bar iron was then threaded on both ends and bent to form a U-bolt passing under the front part of the differential housing at the point where the short shaft from the universal joint to pinion gear is housed. The two ends were then extended up through the frame cross member directly above and secured by nuts and lock washers.

These methods of attachment of both transmission and rear end preserve alignment of the power train, afford the necessary rigidity of suspension, and at the same time make it possible to remove any component parts for repair.

The frame was cut off 16 in. to the rear of the axle housing and a piece of an old car bumper was welded across for the purposes of strengthening the frame and serving as a tow bar for trailer and hay rake or other implements requiring a higher support than the regular draw bar. The cutoff end of the frame was retained to serve as a frame on which to mount driver's seat and gas tank as will be described later.

The service brakes were linked through the original car transverse equalizer bar to the foot pedal, and the emergency brake drums of the truck rear end were linked independently to two hand levers mounted on each side of the truck transmission. The brakes thus mounted gave conventional control for highway driving plus differential braking which has proved very useful in harrowing and the occasional slippery spots in plowing. The hand brake levers were equipped with dogs which could be dropped into place to hold them for use as conventional emergency brakes.

A piece of ½ by 3 by 4-in. angle iron was then square bent, 8 in., from each end perpendicular to the 4-in. surface and with the 3-in. surface extending in the opposite direction from the 8-in. bend. To effect this bend and allow proper wheel clearance after installation as a drawbar it was first necessary to remove the 3-in. surface for a distance of 8 in. from each end. This angle iron was then drilled in the 4-in. face with seven ¾-in. holes 4 in. apart on centers and in line 1½ in. from the junction of the 3 and 4-in. faces. It was then clamped in position 6 in. to the rear of the differential pan with the top of the 4-in. face at a height of 15 in. above the floor and welded in position. This makes a very acceptable drawbar, amply strong and conveniently located.

The end of the main frame was then converted to a rectangular shape by welding a piece of 1¼-in. light angle iron across the two cut ends. The short transverse spring which was original equipment on the rear of this end of the frame was disconnected from the shackles but left attached to the rear cross member of the rectangular framework. The ends of the bottom leaves of this spring were then bent upward 3 in. from each end which made the assembly the proper width to set crosswise of the car frame with no overhand to interfere with wheel rotation. The two pieces of ½ by 3 by 8-in. iron which had been cut from the drawbar were then drilled 1 in. from each end to receive the spring shackle bolts. They were then bent to form a 4 by 4-in. angle and welded, one on each side of the main frame, 33 in. from the rear and with the hole up. The short rectangular frame was then placed in position on top of the regular frame so that the holes in the ends of the transverse spring coincided with those of the 4 by 4-in. angles. They were connected by using the original spring shackle bolts. With the spring action thus destroyed it forms a solid rear support for the rectangular framework. Two pieces of ⅜ by 1¼-in. bar iron, 15 in. long were welded in place from the front corners down to the frame to support the front, and to form a rear stop to keep the floor boards in place. A coach type bucket seat was then mounted on this framework behind the steering wheel. Immediately to the rear of this seat, on the outside left-hand corner of the framework, one of the old running board brackets was inverted and welded into place. An old headlight was mounted on this bracket in such a manner that it could be swiveled in any direction. Two headlights were mounted likewise on the front fenders and all were connected into the regular light switch in such a manner that the rear light can be used either independently or in conjunction with the front ones.

A piece of 2 by 10-in. plank 25 in. long

Fig. 7

Fig. 8

Fig. 9

Fig. 10

was then bolted into place lengthwise of the framework and on the right side, overhanging this side by 2 in. The original Peerless gas tank was then mounted on this plank using the original strap bolts and end bolsters by which it was attached to the car. A ⅛-in. pipe plug was substituted for the fitting in the top and the gas line connected to the fitting in the bottom formerly occupied by the drain plug. A glass sediment bulb and shutoff was connected into the line below the tank and the gas allowed to feed to the carburetor by gravity. The original vacuum tank was disconnected from the carburetor and connected into the main gas line through its drain plug fitting in the bottom. This fitting is equipped with a shutoff valve and the vacuum tank is now used as an auxiliary storage tank holding about a gallon of gas. This arrangement allows a mixture of gas and kerosene to be used in the large tank, with a supply of pure gas in the auxiliary for starting the motor when cold. The carburetor bowl was drilled and tapped and a ⅛-in. pet cock installed to drain the mixed fuels before allowing pure gas to run in.

To the rear of the driver's seat and gas tank, a plank platform 27 by 33 in., with 6-in. sideboards was bolted to the main frame of the tractor. This has been found very desirable for carrying tools and supplies as mentioned previously, and in case additional weight is desired rather than chains to eliminate wheel slippage, it can be added here.

This tractor has been used continuously since it was made in 1939 for general work on the writer's 102-acre farm, and in the gardens of all the neighbors, and more recently here in the Virginia Polytechnic Institute farm shops in giving rebuilt machinery of all kinds its field test before returning it to various owners. It has been subjected to many severe tests under varying conditions and with all kinds of operators, but the only replacement that has ever been necessary was a new float in the carburetor. It is apparently in as good condition now as when built and promises to give many years of satisfactory service.

As regards the cost: It took 169 man-hours of labor to build it in a well-equipped shop. This includes an estimated 10 hours of welding which would cost more if no welding equipment were available. The original car was a discarded old family retainer which might have been valued at about $25. The truck parts, welding rod, and iron cost $44, which was approximately the total cash outlay.

TWENTY-THREE YEARS OF COOPERATION

Readers of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION may recall an article presented in March, 1933, which gave details of a cooperative teacher-training arrangement between Dunwoody Industrial Institute in Minneapolis and the Department of Industrial Education at the University of Minnesota. Professor Homer J. Smith of the University has recently compiled extended data on the agreement and the Dunwoody Press has printed a small folder entitled "Twenty-Three Years of Cooperation." The following figures are shown in summary: 1250 University enrollments in Dunwoody courses, 3312 University credits earned at Dunwoody, 79,488 hours spent at Dunwoody by University students, and 2100 enrollments in University lecture courses taught on the campus by Dr. Prosser, Mr. Bass, and Mr. Craigo of the Institute.

PAINTING DEPARTMENT

A. R. BLOMQUIST

William Hood Dunwoody Industrial Institute

Minneapolis, Minn.

The William Hood Dunwoody Industrial Institute is a trade school with an enrollment of 1500 day school students and 2500 evening school students. Our student body in the day school is built up mainly of two groups. One is the novice group — boys who have generally completed high school and have no trade experience. They enter the two-year course to prepare themselves for trade and industry. The second group is boys and men with more or less trade experience who want to learn about new materials and processes in short, intensive, all-day shop courses.

The painting department at Dunwoody gives training in exterior and interior painting, wood finishing, and decorating. Paper hanging is also taught.

For the regular day school student the work is divided into one half day shop, one quarter day related class, and one quarter day classroom study. The special student (one with previous trade experience) has shopwork practically all day.

The painting shop consists of three units: the stock and mixing room, class and shop, and adjoining rooms for paper hanging, painting, and decorating. In painting, instruction

Spray painting

Working with spraying equipment

is obtainable in both brush and spray techniques. Realizing the many changes in paint manufacture, better coverage, quick drying, and the need for faster application, the school paint shop is equipped with one large power spray and one small portable unit. In training students in the use of this spray painting equipment, job sheets (instruction sheets), written and furnished by the school, are used.

These job sheets are not a general treatise on the subject but a definite instruction sheet pertaining to the particular job the student is about to do; for instance, prepare and set up the power spray equipment. This job sheet will carry instructions under three headings: material, tools, and equipment. General instructions: operation steps, precautions, questions, and references.

Since the students are to be trained so that they will fit into the trade, they are given every opportunity to work with present-day materials, methods, and equipment.

STACK PAN OR UTILITY BOX

HERBERT F. NICHOLS

North Senior High School
Binghamton, N. Y.

The stack pan or utility box described and illustrated herewith is a handy container for small tools, die sets, jigs, cutters, bolts, nuts, and miscellaneous supplies. It may be in various sizes, while using the same type of construction.

This particular container was designed to meet the needs of the machine shops, electrical shops, woodshops, and the sheet-metal shops.

The one illustrated requires a piece of 13 1/16 by 13⅝-in. No. 28 gauge black or galvanized iron. Use black iron if the pan is to be painted or enameled.

Materials necessary:

1. One piece of No. 8 or No. 10 gauge wire 4⅝ in. long.

2. One piece of No. 28 gauge black or galvanized iron 13 1/16 by 13⅝ in.
3. Ten 12-oz. flathead tinners' rivets.
4. Solder and flux.

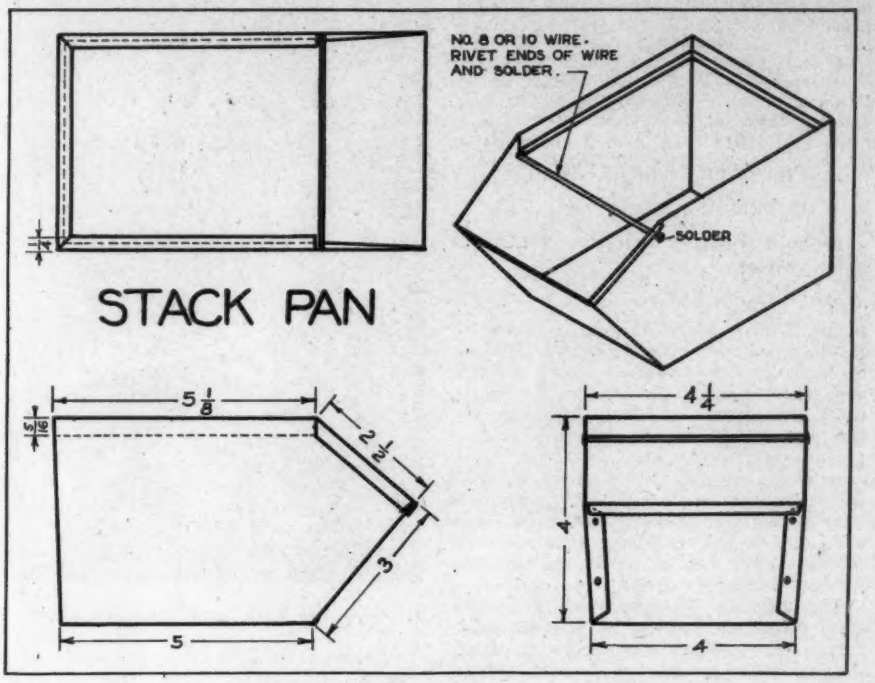
Equipment necessary:

Machines: Squaring shears, bending brake, vise.

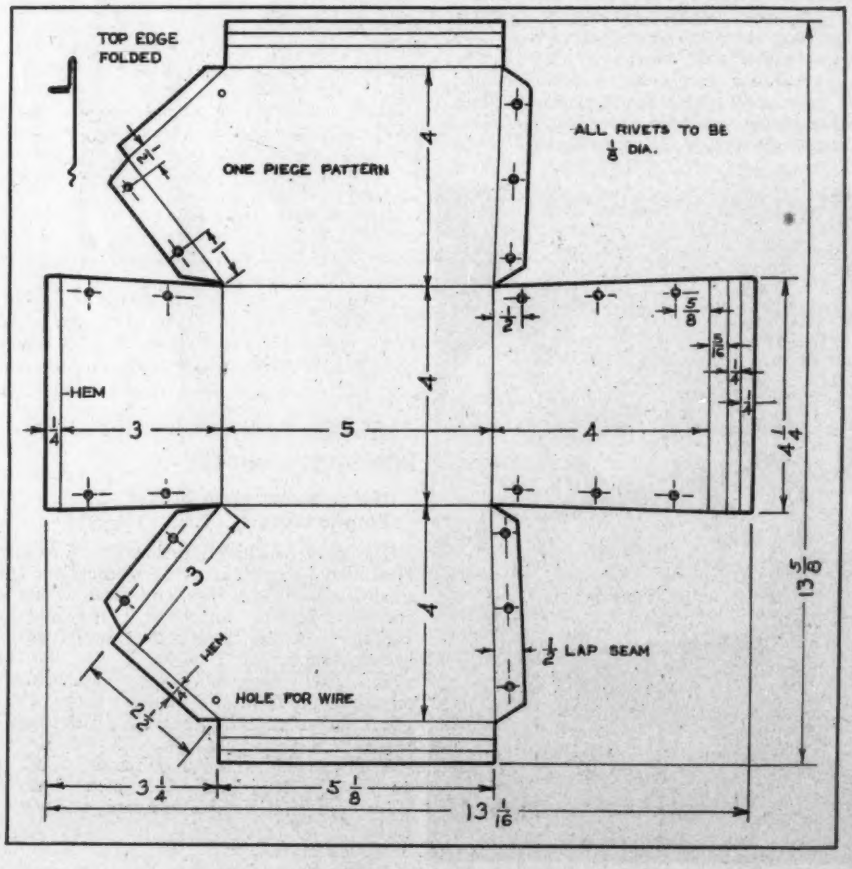
Tools: Rule, steel square, scratch awl, shears (straight), prick punch, hand lever punch, squarehead stake (offset shank), rivet set, hammer (setting), seaming pliers, squarehead stake, mallet, center punch, and file.

Procedure:

1. Draw a semipattern on paper using full-size dimensions.
2. Cut stock to size in the squaring shears.
3. Lay out all lines on the sheet metal using scratch awl, rule, and steel square.
4. Cut out pattern and notch all corners as shown.
5. Locate rivet holes and center punch each.
6. Punch rivet holes with hand lever punch.
7. Prick punch all lines for bending. (Note: Punching the rivet holes before prick punching will eliminate the mistake of punching prick punch marks where bending takes place.)
8. Turn a ¼-in. single hem on the two sides and the back of the pan, as shown.
9. Turn a ¼-in. single hem on the two top edges of the sides and the front of the pan.
10. Bend the two top edges and the top edge of the back at an angle of 90 deg.
11. Make the third bend on the sides and back edges of the pan and close down tight as indicated.
12. Bend the lap seams to a 90-deg. angle. These may be formed with the seaming pliers, or over the edge of a squarehead stake with a mallet.
13. Form up the sides, back, and front of the pan over the edge of a squarehead stake by hand.
14. Rivet the four corners.
15. Cut a piece of No. 8 or No. 10 gauge wire 4⅝ in. long.
16. Insert the ends of the wire in the holes punched for the wire.
17. Hold the wire between the jaws of the vise while heading the ends of the wire.
18. Solder lightly over ends of the wire.
19. File all corners to remove sharp obstructions.
20. Paint or enamel if desired.



Metal stack pan



Layout of stack pan

MOLDING PLASTICS IN HIGH SCHOOL

DALE PETERSON

Formerly Teacher of Woodwork and Hobbies

Irving High School

Salt Lake City, Utah

Now in the U. S. Army

(*Continued from page 160 of the April, 1944, issue*)

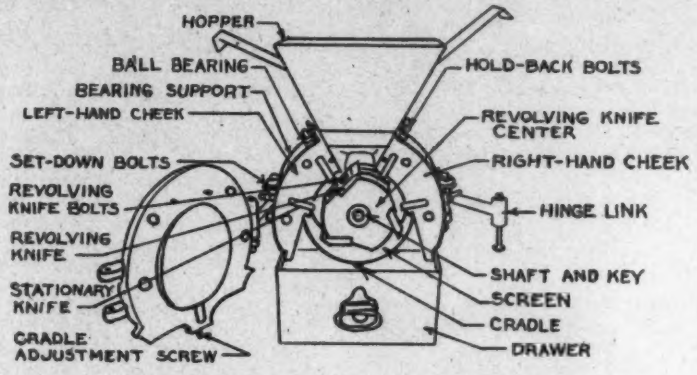
Plastic Molding Powder

Plastic molding powder may be purchased from the manufacturers of plastic materials. It comes in a great variety of colors and it is possible to secure special colors in large orders. The phenolic powders are more limited in their color range than the other types, but they can be obtained in a great variety of darker colors.

It is not necessary to purchase molding powder directly from the manufacturers. Many small jobbing concerns make a specialty of grinding plastic scrap materials into molding powder. Naturally, only the thermoplastics can be reground for further use. They may be used repeatedly unless they are heated so often or carelessly so that the plasticizer is driven from the molding powder. The loss of the plasticizer would impair the quality of the

material but it would only occur after many heatings or careless operation.

There are several grinding machines on the market for reducing scrap plastic material to molding powder. See the accompanying illustrations for pictures of such a machine. These machines are of a size suitable for regrinding the scrap that would occur from molding operations conducted in the school. In this way the scrap could be utilized and the costs of the program reduced. Plastic scrap can also be purchased at low rates or in some cases secured from scrap heaps.



Grinder for regrinding plastic scrap

Before undertaking to regrind plastic material some method of identifying and sorting the scrap material must be found. This is necessary to avoid mixing the different types of plastics, which are often not compatible with each other and would thus make an inferior molding powder.

It is rather difficult to identify plastic scrap by any one method, but it is quite possible to make a positive identification by using several methods. These will now be described.

The first method of identification is by the general appearance and texture of the scrap material. The cellulose plastics in general are of a tough, resilient composition. Thin sections of the material are very flexible and break only after repeated bending. They have a tendency to spring back to shape when bent. They positively will not shatter when hit with a hammer, but have the appearance of a very tough material. The phenolics, on the other hand, are quite brittle and break off leaving rather sharp edges when hit with a hammer. This quality is most noticeable in the cast phenolics, but is also noticeable in the moldings that contain various filling materials. The fillers tend to decrease the brittleness somewhat. Polystyrene is inflexible and breaks without previous bending when subjected to sufficient stress. In other words it has good dimensional stability. The vinyls and acrylics break after a slight amount of bending. There are some vinyls that are extremely flexible, however, and are used as straps for belts, suspenders, and other articles of clothing. This type of vinyl is not used for molding rigid products.

The second and most positive method of identifying the plastics is by smell. When a piece of plastic scrap is broken, sawed, or heated it usually gives off a little of the monomer vapor which has been contained in the solid piece. Thus, a piece of methyl methacrylats will smell like monomeric (liquid) methyl methacrylate when it is sawed, broken, or heated enough to force some of the vapor to escape from the solid piece of scrap material. Also, in a similar manner, vinyl and styrene have their characteristic odor. These odors are readily memorized by smelling some of the liquid monomers. In these cases the odor is that of an ester (sweet smelling, similar to the odor of blossoms).

Phenolic plastics, ureas, and caseins all release formaldehyde fumes when given a similar treatment. Thus, by learning the smell of formaldehyde or furfuraldehyde, it is possible to identify these thermosetting plastics which cannot be reground for further use.

The cellulose plastics can also be identified by their odor. Nitrate cellulose can be identified by the odor of camphor, which is nearly always used as a plasticizer in its manufacture. Occasionally camphor is used to plasticize cellulose acetate but, if so, the two can be readily identified by their burning rate. Celluloid (nitrate cellulose) ignites rapidly and burns like gun powder while cellulose acetate burns much more slowly. Celluloid, because of this high burning rate and explosive nature, should never be used in a school shop.

Sealed fruit jars make good containers to keep moisture out of the molding powder

BINDING THE SCHOOL ANNUAL IN THE PRINT SHOP

WAYNE A. WONACOTT

Instructor of Printing

Hollenbeck Junior High School

Los Angeles, Calif.

It is comparatively simple to put a cloth binding on the school annual in the printing department. As most junior high schools publish a yearbook with only a paper cover, there is definite room for improvement. With very little special equipment, an attractive binding can be made which will greatly increase the appearance and the value of the book.

The paper-bound annual is nothing more than a magazine, but when it is cased in a hard cover it becomes a book, and the contents have better protection and can be saved for many years.

By doing the actual production work in the print shop many students are given an experience in bookbinding which could not be had except in industry itself. Besides this, the bookbinding broadens the scope of the graphic-arts course, and the student is able to explore a little more of this vast field.

For five semesters Hollenbeck Junior High School of Los Angeles has produced hard covers for the annual in the print shop. About 10 per cent of the number printed are given the special binding. This usually amounts to from 150 to 175 copies.

During the middle of the semester a subscription drive is held to sell these special covers. The demand has been so great that the subscriptions have been limited to the graduating class. Advance sale of the binding eliminates waste as well as disappointments.

The art department also has a part in the production. They are given the job of making the design which is silk screened on the front cover. Interdepartmental cooperation is thus stimulated.

Approximately a month before the date

Figs. 1 and 2. Printing the cover design and using the silk screen process

Fig. 3. Completing the case

of publication the supplies are obtained from a local bookbinder's supply house. The equipment is put into shape and the job is ready to begin.

Equipment

1. Silk screen outfit. Includes screen, squeegee, and sharp knife, etc. See reference on the silk screen process.
2. Bookbinding equipment. Scissors, folding bones, rulers and yardstick, double boiler, glue brushes, press (heavy weights will do).

Supplies

1. Silk screen stencil film.
2. Stencil film solvent.
3. Silk screen paint.
4. Silk screen paint solvent.
5. Bookbinder's granulated or flexible glue.
6. Binder's board No. 20. Take a good grade.
7. Waterproof cover material. Many types are available.
8. Supercloth.
9. End papers.

There are available so many good books on how to make a case and bind a book, that details are not necessary. Therefore, only the general steps in producing the cover are listed in the following.

Making the Case

1. Cut cover material to size.
2. Silk screen design on cover material.
   a) Cut cover design out of stencil film.
   b) Adhere film to screen.
   c) Print design on cover material and lay out to dry. See Figures 1 and 2.*
3. Cut binder's board to size.
4. Mix glue with water and cook in double boiler.
5. Complete the case. See Figure 3.
6. Press cases under weights for several days.

*All photographs for this article were made by Robert Williams, Department Head, Hollenbeck Junior High School, Los Angeles, Calif.

Figs. 4 and 5. Casing and finishing the book

Casing in the Book

1. Print design on end papers.
2. Cut end paper to size.
3. Glue supercloth to end papers.
4. Attach end papers to book.
5. Hang the book in the case. See Figure 4.
6. Press books for a day or more.
7. Clean covers with damp cloth.
8. Finished product. See Figure 5.

AIRPLANE SHEET-METAL SHOP PRACTICE

M. D. CAFFIN

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Newark, N. J.

(Continued from page 46A of the March, 1944, issue)

Fabrication of Airplane Parts

Sheet aluminum alloys used in airplane manufacture are with few exceptions fabricated with the same tools and equipment common to the sheetmetal worker, i.e., snips, squaring shears, cornice brake, forming rolls, power presses, etc. There have naturally been some modifications, and in certain instances new types of fabricating equipment developed in the aircraft plants in order to meet requirements peculiar to both the aircraft metal and type of manufacturing.

Light gauge sheet aluminum alloys are cut by hand, with the regulation tin snips, or aviation snips, a similar type developed for aircraft work. Machine cutting is done with the squaring shears, or with a shearing die in a power press. Before the present war when airplanes were individually made, the squaring shears and cornice brake were used for most cutting and bending of parts. However, today large presses adapted for mass production of parts are used.

These presses are generally of the hydraulic type, and can exert hundreds of thousands of pounds of pressure. For bending or forming, a form to which the sheet aluminum alloy is to be formed is made. Here again new developments have greatly speeded up the process. Where previously it was necessary to make a male and female form similar to the punch and die used in stamping work, today either the male or the female form may be used in conjunction with a thick rubber platen on the hydraulic press. The metal is formed over the

SUPPLY REQUISITION AND INVENTORY SHEET

DEPT. Art Metal — INSTRUCTOR Weatherford

NO.	DESCRIPTION	VENDOR PREFERRED	1939–40 Ordered for Sept. 1, 1939	1939–40 Price Ord.	1939–40 Total Ord.	1939–40 Inventory June 15, 1940	1940–41 Ordered for Sept. 1, 1940	1940–41 Price Ord.	1940–41 Total Ord.	1940–41 Inventory June 15, 1941	1941–42 Ordered for Sept. 1, 1941	1941–42 Price Ord.	1941–42 Total Ord.	1941–42 Inventory June 15, 1942	Budget for Sept. 1, 1942
1	Brass, 12x96, Sheet, 16 B+S gauge	C. H. Mansdel Co., San Francisco	4 Sheet	.30		2	2	.30		1	3				
2															
3	List every size of each material, even though it may not be ordered every year. Leave lots of blank spaces between groups of materials for addition of other items later on.														
4															
5															
6															
7															
8															
14	Copper, 30x96 Sheet, 32 g. Cold Rolled	Pacific Metals Co.	10	.21	42.00	4	6	.21	25.20	3	7				
15	" " 24 g.	"													
16	" " 18 g.	"													
17	" 12x96 " 16 g.	"													
18															
32	Sample of supply requisition and inventory used in Industrial Arts Department Laboratories, San Jose State College, San Jose, Calif.		No headings are printed for these columns, permitting each instructor to adapt them to his own particular problems or fancy.												
33															
34															
35															
36															

Requisition and inventory form submitted by Marion T. Weatherford, Division of Industrial Education, San Jose State College, San Jose, Calif.

die by the tremendous pressure exerted against the rubber platen, which in effect then flows around the form, thus causing the sheet metal to be shaped to the form.

This method saves much time formerly spent in making dies, and produces better formed parts. It was developed in various airplane plants, and is today used in most large plants. Heavy tempered Masonite die stock may be used for the form, or other similar suitable material which is tough, and can withstand hundreds of tons of pressure, and yet can be shaped with woodworking tools.

With all of the specialized types of developments in making airplane parts, certain hand tools still remain a necessary part of the aircraft worker's equipment. The hand file is a tool most essential to him. It is used to finish machine stamped parts, to remove burrs, etc., and it is important that an aircraft worker have a working knowledge of the various types of files, and their use.

Following are briefly listed some suggestions relating to the selection and use of files for aircraft work:

Bastard and second cut files are used on aluminum and aluminum alloys. A smooth cut file would soon clog on these soft metals and become useless.

The file cuts best on the forward stroke. Relieve pressure on the return stroke.

A single cut file will produce the best finish; double cut files are used to remove metal more rapidly, but do not produce as fine a finish.

A clean file cuts best. Use a file card (brush) to remove filings between the file teeth. Do not try to remove them by rapping the file against some other object.

Best filing is done when in a standing position.

All work to be filed should be firmly gripped in a vise or held securely with a clamp.

Do not permit the file to strike other metal surfaces. This soon dulls the edges of the teeth.

Do not use a file without a handle. A handle makes it easier to manipulate, and safer to use.

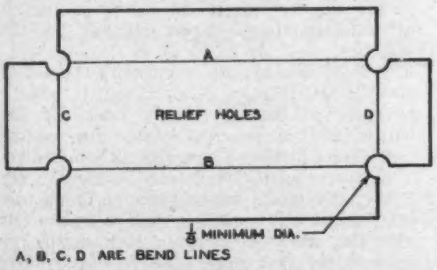


Fig. 1. Relief holes

Relief Holes: A relief hole is a hole made at the intersection of two or more bends in a piece of sheet metal. Its purpose is to remove some of the metal in the corner formed by the bend, and thus relieve the strain that is produced. This helps also to avoid creases and cracks that might result at the point where two or more bends meet. A bend might be made to intersect another bend with a crack resulting therefrom. But under the stress and strain of vibration it would be certain to develop.

Relief holes are usually not smaller than ⅛ in. in diameter. They may be figured at 4 times the thickness of the metal in which the hole is to be made. Thus, a sheet .051 in. would have a relief hole approximately 3/16 in. in diameter. See Figure 1.

Joggling: When two pieces of sheet metal are to be joined, it is desirable to maintain the single surface thickness. In order to maintain the flush surface, one of the parts may be joggled, i.e., it is bent to an offset equal in depth to the thickness of the piece of metal to which it is to be joined. In addition, sufficient metal is allowed on both pieces to permit an overlap of the end, as shown in Figure 2.

Joggling is accomplished with male and female dies or with either one or the other used in conjunction with the rubber platen previously mentioned in a press. Since the bend is not sharp, the joggle may be formed on hardened (ST) stock or annealed SO stock.

Fig. 2. The joggle

Assembling fabricated parts: In the final assembly of parts the last and most essential assembly operation is riveting. However, before riveting it is necessary to temporarily assemble the parts, and frequently to disassemble them to remove burrs that may form between sheets that are drilled together. It is, therefore, necessary to utilize a quick, strong type of temporary fastening. Of these there are several kinds widely used in aircraft plants. The most common are: self-tapping sheet-metal screws, machine screws and nuts, and patented type spring sheet holders.

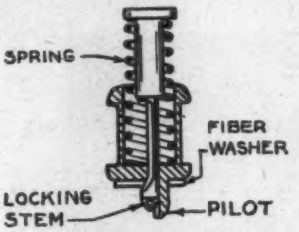


Fig. 3. Spring sheet holder

Of the foregoing, the first two types are sufficiently common to need no further discussion, except to state that it is necessary to use some kind of protection against scratching the sheet metal with the underside of the head of the screw. Fiber or metal washers are used for this purpose, one type of screw being furnished by the manufacturer with a fiber washer assembled to the head.

The patented type spring sheet holder is made in varying designs by several manufacturers, and is probably the most widely used type of temporary fastening used in aircraft work today. One of the common types of sheet holders is shown in Figure 3, together with its application with a forceps or pliers, as shown in Figure 4.

Fig. 4. Pliers used for applying spring sheet holders

These sheet holders are furnished in sizes from 3/32 to 3/16 in. The pilot and locking stem are made to the hole diameter that is to be used for the rivet. Thus, there is no redrilling required after removal of the sheet holder, and before application of the rivet. A fiber washer is located on the sheet holder at the point where it might otherwise be likely to scratch the sheet-metal surface. There are various styles of pliers used for holding and compressing the sheet holder prior to its application to the hole. As the pliers are squeezed together, the sheet holder is compressed and the stem will fit into the hole. However, when the pressure is released from the pliers and the holder is no longer compressed, the stem cannot return to its original position because together with the pilot it is too large to pass through the hole. The pull of the spring on the sheet holder thus holds the two or more sheets together securely.

RUBBER PLATES IN THE SCHOOL PRINT SHOP

OTIS H. CHIDESTER

Senior High School
Tucson, Ariz.

Although rubber plates have been in use for several years, rubber plate printing has grown slowly in both school and commercial shops; but in the opinion of outstanding authorities it has a place in both fields due to its wide versatility, ease of cutting, make-ready, and length of life in running time.

Linoleum blocks, though in use for about 25 years, have grown popular only in the past few years; this is due to the limited uses to which they can be put.

On the other hand, rubber plates have had a slow beginning because of the fact that cutting requires an entirely different, yet simple, method of preparation; in most cases users have been attempting to apply the method of linoleum block cutting and thus have failed to obtain the desired results and also have found the rubber plaster difficult to cut in that manner.

A comparison between rubber plates and linoleum blocks is made simply for illustrative and informative purposes and with no idea of minimizing the value of the latter, as each has a field in which it should be used.

Rubber plates consist of two thicknesses of rubber held together on the wood block by thin layers of fabric. The rubber is about 1/16 in. thick and the blocks are usually of laminated wood to eliminate warping and presswork difficulties. See Figure 1.

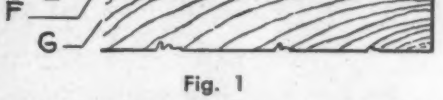


Fig. 1

Rubber plates already have many uses, and many others are being discovered as the necessity arises. The most common use is to supplement display materials with cheap plates. Special designs for title pages are among the outstanding uses. One of the more recent developments is the use of rubber plates as supplementary color plates for a line cut or photoengraving, thus obtaining the effect of

color plates without the additional expense of costly photoengraving plates. Rubber plates are also used for tint blocks in all types of commercial work for the addition of special emphasis to various parts of display materials by adding color to certain sections or by blocking out other sections.

An outstanding advantage of the rubber plate is its solid, smooth surface which enables it to carry a full body of ink and to print an area with a solid color without the mottled surface often resulting from linoleum blocks.

Fig. 2

Fig. 3

Fig. 4

The first step in the cutting of the rubber plate is the same as that in preparing any other type of plate reproduction. The desired design is drawn upon a sheet of folio with a medium soft lead pencil. It must be remembered that it is difficult to obtain lines that are very fine or very complicated; for this reason the design should be suited to the medium used.

The plate is cut to desired size, and the protective surface of wax which comes on the rubber surface is removed with gasoline and a clean, soft cloth. If the design is fine enough to warrant it, the surface of the block can be covered with a thin coat of white poster paint so that the design will show more readily.

The design is then placed face down on the surface of the rubber and fastened with Scotch or gummed tape. See Figure 2. The back of the folio is then rubbed firmly with a smooth object such as a round pencil. A slight pressure should be sufficient to transfer the design to the surface of the plate. Remove the design carefully in case you should need it again. Inspect the design to see that all lines desired have transferred. If any are missing, fill in with soft pencil having a fairly blunt point.

In order to prevent rubbing off the design during cutting, spray the surface with a thin coat of mixing solution. This is made up of one third white shellac and two thirds wood alcohol. Stand the plate on edge and apply the solution from a bottle spray held about 2 ft. from the block and sprayed so that a fine coat covers the block smoothly. The solution will dry in a few minutes, and the block is ready for cutting.

The first step in cutting the plate is to outline the design lightly, using the straight-edged and curved knives. With sharp tools and a little practice the cutter will be able to go through the rubber surface to the proper depth with one cut. Do not attempt to cut through all layers of rubber except in large exposed sections where the paper is likely to pick up a roller smudge. Cut through only to the first fabric layer, shown at D in Figure 1.

In making these cuts the knife should be held at an angle so that the body of the design will have a shoulder sloping away from it, as shown in Figure 3. This adds strength to the printing surface and helps to eliminate a fuzzy, weak edge. When the knife is held exactly perpendicular or at an angle which will undercut the design, the surface is weakened and there is a tendency that the printing edge will be ragged. When there is little exposed surface it is not necessary to cut through to the fabric. It will be sufficient to cut a V-shaped piece of rubber strip in accordance with the width of the cut.

With a little practice the cutter will be able to tell when he reaches the fabric layer because the point of the knife cutting across the fabric will give a slightly different resistance than it does when it cuts through the rubber. It is well to practice until one is able to cut the rubber without cutting the fabric, because the frayed threads leave ink smears on the finished product. In wide open spaces it is well to cut through to the wood base and remove both rubber and fabric layers.

In cutting straight or fairly straight lines use the straight-edge knife, and in cutting curved lines use the curved knife. Never cut *into* a corner, but start in the corner and work out, letting the knife cuts meet along a fairly straight or open edge whenever possible. The fineness of the lines that can be cut is limited only by the mechanical dexterity of the cutter and his willingness to practice cutting.

Rubber-plate cutting differs from linoleum-block cutting in that with linoleum various-sized V and U gouges are used in removing background, while in rubber only the smallest V gouge with extremely sharp edges should be used for fine detail work. The process of removing the larger rubber surfaces which should not print is called stripping. This is done as shown in Figure 4. When the area to be removed has been cut completely around the edge and through to the first fabric, insert the straight-edged knife between the first rubber layer to loosen a small area, then take a pair of stripping pliers (pointed nose) and carefully strip off the rubber layer. To do this successfully requires that the rubber is completely cut through to the fabric so that it will not tear into the design and thus spoil the work.

Straight lines should be cut with the aid of a metal straightedge. A metal square will be of value in cutting straight lines for the border and in squaring plates for cutting from larger blocks. A compass with an attachment for a cutting blade can be used to cut circles. Dividers will sometimes be found useful in laying out work. It is well to have a few mounting nails on hand to tack down any loose edges that may arise. A fine-grained whetstone is essential to keep tools at maximum cutting efficiency. As time goes on, the individual will find other tools which will aid him in his work.

(*To be continued*)

COPY FORM AND JOB RECORD ENVELOPE

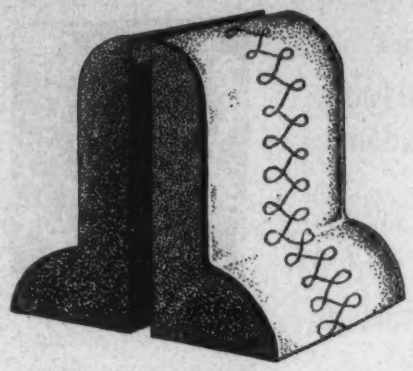
BERNARD G. SWIFT
Pearl River, N. Y.

The *copy form* shown in Figure 1 makes it a very simple matter to route small printing jobs such as tickets, slingers, etc., through the school print shop. The copy form also becomes a very useful part of the shop records.

As part of the shop records the copy form

(Continued on page 214)

WHAT DECORATIVE PROCESSES SUIT LEATHER?



Leather-Covered Book Ends with Tooled Decoration from America House, N.Y. City

1. The natural markings of many leathers, such as alligator or ostrich, are sufficient decoration in themselves. Artificial textures, suede, polished, or embossed, increase the variety of basic surfaces.

2. Colors, inherent in the material or added by stain or dye, provide opportunities for harmonious adjustment to other articles.

3. Contrasting colors may be inlaid, or fastened as an applique to the surface.

Pencil with Reptile Leather Cover — America House

Mexican Tooled and Embossed Card Case

Thonging

Candle Shield from Portion of 14th Century Choral Mss, Laced to Frame

4. Leather may be tooled, carved, or embossed, and left blind, or gilded.

5. Thonging (or lacing) in great variety of forms, adds a note of interest as well as serving a structural function.

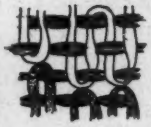
6. Strips, used for handles, etc., may be plaited to increase strength and interest.

Plate 36. Design course by Burl N. Osburn, director of industrial arts, State Teachers College, Millersville, Pa.

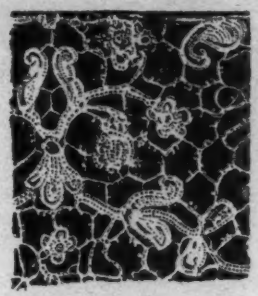
WHAT ARE THE BASIC TEXTILE STRUCTURES?

Coptic Weaving
Boston Museum of Art

The textile designer must understand thoroughly the structure of his medium.



1. Threads are worked with needle or bobbin.



Venetian Rose-point Lace-Pellew, Seven Centuries of Lace

Tape Cloth

2. Weft threads are interlaced at right angles to warp threads to weave varied patterns.

3. Fibers are matted or "felted" in random arrangement.

American Hooked Rug

4. Yarns or strips are drawn through a base or twisted into warp and weft in pile fabrics.

5. Cords are twisted together and tied.

Tassel from an Edging

Knitted Mittens

6. Yarns are drawn through loops in a continuous chain.

Plate 37. Continuation of design course by Burl N. Osburn, director of industrial arts, State Teachers College, Millersville, Pa.

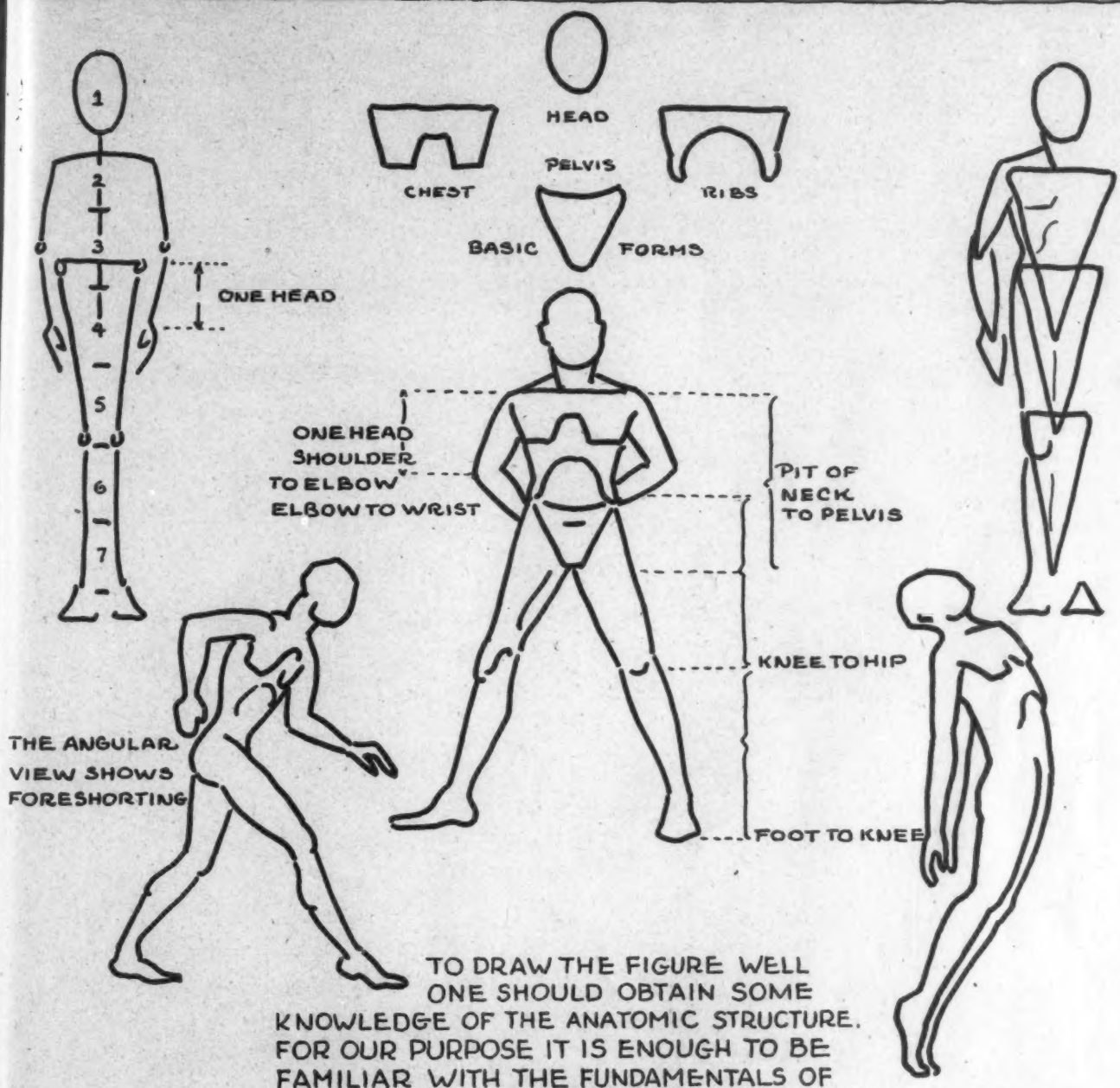
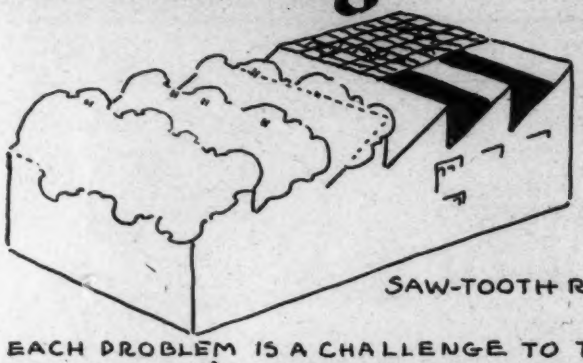


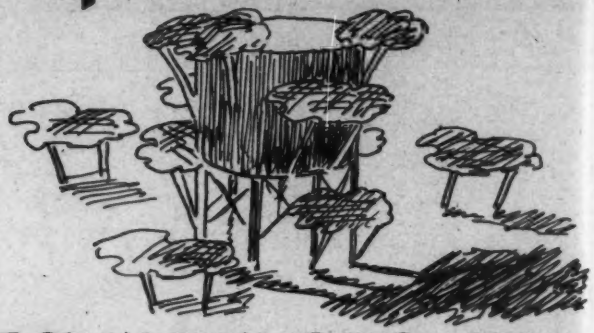
Plate 20. Creative design course by Richard E. Bailey, chairman, art department, Central High School, Providence, R. I.

Camouflage



EACH PROBLEM IS A CHALLENGE TO THE CAMOUFLEUR'S CREATIVE ABILITY · · · ABOVE ARE TWO WAYS OF DISRUPTING THE SHADOW OF A GABLE ROOF

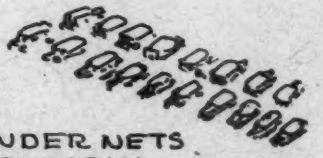
Special Problems



THE ROUND FORM OF THE WATER TOWER IS VERY CONSPICUOUS · THIS SUGGESTS ONE WAY OF CONFUSING ITS SHADOW AND APPEARANCE ·

THE CHIMNEY FROM THE AIR IS HARDLY NOTICEABLE BUT THE SHADOW REQUIRES ATTENTION

REGULAR LINES OF CARS ARE VERY CONSPICUOUS BECAUSE OF ARRANGEMENT AND THEIR REFLECTIVE SURFACES

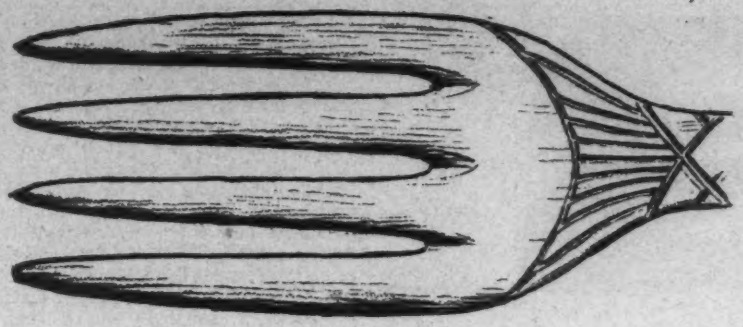


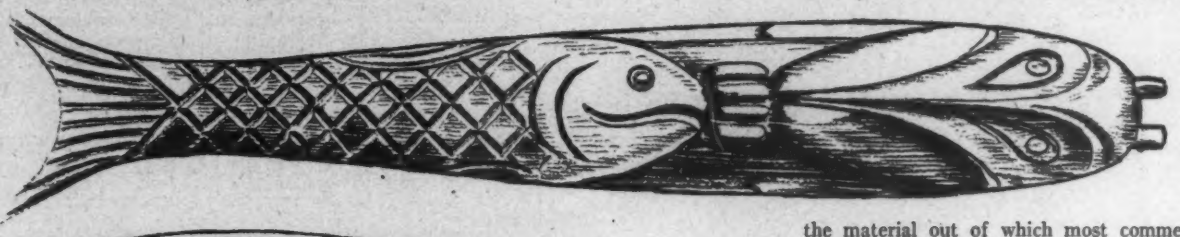
CARS UNDER NETS OR IRREGULARLY PLACED UNDER TREES ARE MORE DIFFICULT TO SPOT

WE MAY USE OVERHEAD SCREENING · CROSS SCREENING · · ECHELON SCREENING

A KNOWLEDGE OF BASIC PRINCIPLES, CREATIVE ABILITY, CONSTRUCTION ENGINEERING, AND LANDSCAPE ARCHITECTURE COUPLED WITH OLD-FASHIONED HORSE SENSE MAKE FOR SUCCESSFUL CAMOUFLAGE · ·

Plate 14. Camouflage course by Richard E. Bailey, chairman, art department, Central High School, Providence, R. I.





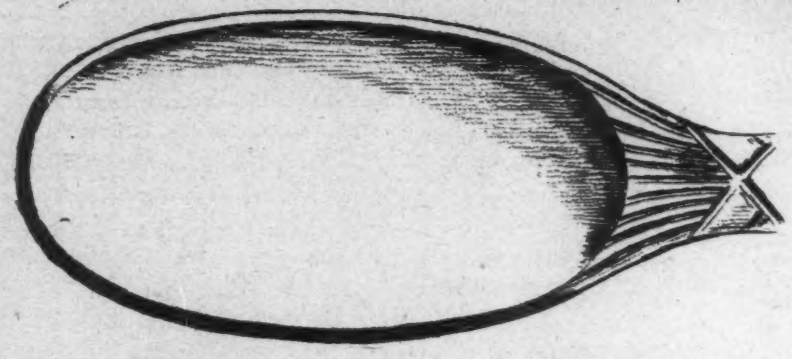


Fig. 144. Full-sized pattern of the salad fork and spoon

WHITTLING-JACKKNIFE TECHNIQUE

W. BEN. HUNT

Hales Corners, Wis.

(*Continued from page 170 of the April, 1944, issue*)

Salad Fork and Spoon

For the whittling project shown in Figures 144, 145, and 146, you will need two pieces of rather hardwood, 1¼ by 2 by 10¼ in. Probably the best wood for the fork and spoon would be maple, although this is rather hard to whittle. Birch cuts more easily and is the material out of which most commercial salad forks and spoons are carved. Walnut and mahogany also may be used, but a filler must be applied on both of these woods to close the pores, and give the salad set a smooth finish. Lemonwood or cherry could also be used for this project.

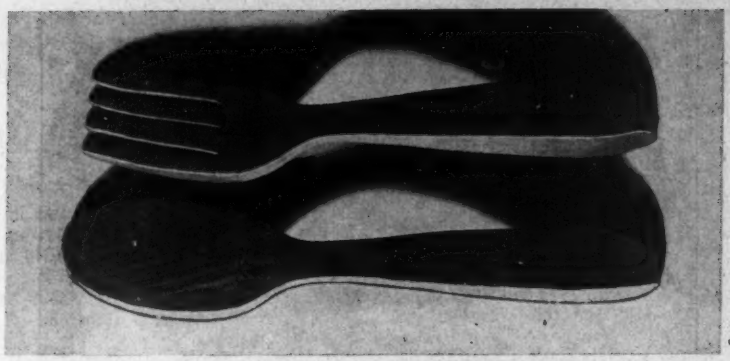
To simplify the pattern drawing shown in Figure 144, the handle is shown but once in each view. If the whittler so desires, the fish may be carved in one position on the fork and then reversed on the spoon as shown in Figure 146.

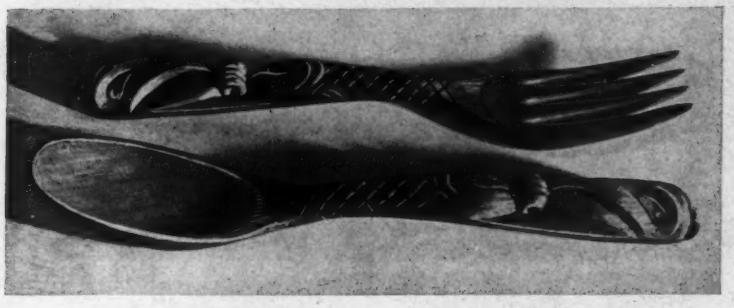
To prepare the blanks, cut out the silhouette, using the side view as the pattern. Then trace the top view on the silhouette just sawed out, and cut off the waste wood. This procedure saves considerable time in doing the actual whittling.

The crooked knife shown on page 78 of the February, 1942, issue of this magazine was used to carve out the bowl of the spoon. If you do not have a knife of this kind, you will have to use a gouge, as a pocketknife cannot be used to do this job.

After the whittling has been completed, the fork and spoon may be left with the knife marks showing, or they may be sanded down smoothly. If walnut or mahogany has been used, a suitable paste filler must be applied first. The filler, when dry, must then be followed by a sealing coat of thin white shellac, and after that is dry, the whole should be rubbed down carefully with steel wool. Two coats of floor spar varnish, rubbed down with crude oil and pumice stone, will then complete the finishing operation.

Other methods of finishing also might be used. Thus, two coats of clear lacquer could be applied. Or, if the fork and spoon are made of fine-grained wood, they might be given a series of well-rubbed coats of salad oil, until a fine natural finish is effected.





Upper, Fig. 145. Blanks for salad fork and spoon
Lower, Fig. 146. The finished salad set

JUSTIFICATION

LEONARD E. SCHMIDT
Printing Instructor, Lincoln Hall
Lincolndale, N. Y.

After a boy has learned his case and starts to set type, he is confronted with the problem of getting the words to fit into the stick in a snug manner. This is perhaps the hardest task he will have to master, as a line that is not justified is of no value from a printer's viewpoint.

Many methods have been advanced to help the compositor find the next smaller or larger space to the one he is using, and while all are accurate and dependable, they are for the most part too difficult for the boy in the school shop.

Here is a simple way for the student to remember the different combinations of spaces, regardless of the size of type used.

Each space in the case is given a unit value. Since the em quad is the basis of this system, we start with that size. The larger quads are multiples of the em quad.

Em quad	10 units
En quad	5 units
3-to-em space . . .	3 1/3 units
4-to-em space . . .	2½ units
5-to-em space	2 units

The 3-to-em space is actually three and a third units, but for easier figuring, we make it 3½. This will in no way change the order of thickness.

Using this system of units, we can add together the value of any combination of spaces, and get the next larger or smaller space whether we are setting 6 point or 48 point.

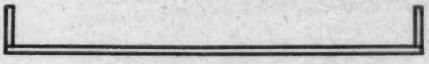
In order to be sure that the system is fully understood, here are all the combinations in their right order, using only the spaces found in the case.

10 units . . . em quad
9½ units . . . en quad, 4- and 5-to-em space
9 units . . . en quad, and two 5-to-em spaces
8½ units . . . en quad and 3-to-em space
8 units . . . 3-, 4-, and 5-to-em space
7½ units . . . en quad and 4-to-em space
7 units . . . en quad and 5-to-em space
6½ units . . . two 5 and one 4-to-em spaces
6 units . . . 3- and 4-to-em space
5½ units . . . 3- and 5-to-em space
5 units . . . en quad
4½ units . . . 4- and 5-to-em space
4 units . . . two 5-to-em spaces
3½ units . . . 3-to-em space
2½ units . . . 4-to-em space
2 units . . . 5-to-em space

Handy Teaching Aid

Perhaps the easiest way to get across the lesson, or lessons, on justification is by demonstration. Since it would take a great deal of the instructor's time to go from one boy to another and show in the stick how the justifying is done, this method is offered as a timesaver and a practical means of explaining justification.

First secure a board ½ in. thick, 6 in. wide, and 48 in. long. Cut off two 4-in. pieces from the 48-in. length. Nail one of these upright on each end of the remaining board as illustrated below. This now becomes our *stick*.



The stick

Next, get a piece of wood 4 by 4 by 96 in. Cut off five pieces 6 in. long, and as many 8-in. pieces as possible. Take one of the 6-in. pieces and cut it into five even pieces across one of the 4-in. ways, as follows:

5-to-em space

The saw will take away part of the 4 in., so that when the five pieces are placed together they will be much narrower than 4 in. — perhaps about 3 1/3 in. Whatever the size they come to, trim the other side to the same size so that we have a square.

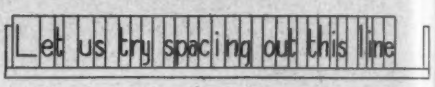
These become our 5-to-em spaces.

Now trim all the pieces on one side to 3 1/3 or whatever the exact measure is.

Take a second piece and divide it into four parts that when put together will form a square. These will be our 4-to-em spaces. Do the same for the 3-to-em space and en quad, and trim the remaining piece square.

That takes care of the spaces. Now to make some pieces of type. All the 8-in. pieces are now 4 by 3 1/3. Divide the 4-in. way into pieces of varying size. The thickness of each piece will be determined by the letter it is to represent. A lower case *i* will be narrow, while a capital *M* will be much wider.

Cut enough letters to make up a few simple sentences that will fit, or almost fit, the *stick*. Work out the sentences so that it will be necessary to change the spaces in order to get a snug line. The two examples that follow will illustrate this point.



The entire class may then watch as one or more of the boys suggest how to solve each problem. Allowing the boys to do the changing of spaces is a good idea.

The building of this outfit will be a simple matter if the woodshop has a circular saw and will cooperate. The entire outfit will cost less than a dollar and should last for many years.

If the pieces are painted white, with black characters marked on each end, it will be easy for the teacher as well as the students to see them clearly during the demonstration. The spaces should have their sizes marked on them to tell them apart.

Along with the unit chart, this teaching aid should solve the problem of justification in an interesting way.

COPY FORM AND JOB RECORD ENVELOPE

(*Continued from page 208*)

can be of use for future use in setting up jobs and as an aid in instruction. It is filed away with the *job record envelope* shown in Figure 2, so that it is always available for future use.

The copy form may also be used when the students study layout work. When using the forms in this way, suggestions for possible improvements on the job are written on the copy form and in this way definite steps are taken to improve the layouts for future use.

The copy form is made out and approved by the instructor before the job is started. It is filled out either from the copy submitted for the job or is made out directly by a student or the instructor to meet the requirements of the job at hand. In every case, the job number is always made part of it so that it will be filed in the correct job record envelope. When filling out the form directly from copy submitted, the line number, copy, size, and kind of type are all filled in at the same time.

Copy forms also are available, so if a production job for the school comes up, the copy column of the form can be filled in by

PEARL RIVER SCHOOL
PRINT SHOP

COPY FORM

Job No. _____ Description of job _____

Page No. of job _____

Pica Measure _____

Copy	Line No.	Size and kind of type

Fig. 1. The copy form

Pearl River High School
Print Shop

Job Record Envelope

Job No. _____

Description _____

_____

_____

_____

Size _____

Stock _____

Amount Required _____

Time Started _____

Time Completed _____

Type Setting _____

Lock Up _____

Presswork _____

Received By _____

Fig. 2. Job record envelope

the person wanting the job done. The balance of the copy form can then be filled out by the students. That is, they can apply the principles and practices of layout when they fill in the portions of the form stating the size and kind of type used.

The copy form is kept at the type stand while the student is setting the type for the job. In this way he has before him the copy with all of the information that he will need to set up the job. It also makes it easy for another student to take over the job in the event that the first student has to leave it for any reason.

The copy form, original copy, if any, proofs, etc., are kept in the job record envelope shown. This gives a very complete record of all jobs that are done in the print shop.

TAPING C CLAMPS

WILLIAM H. PORTER
High School
Northport, N. Y.

In our high school woodworking classes, we find that the covering of the two clamping surfaces of C clamps with drafting tape helps appreciably in preventing clamp marks being left on the wood.

Disks of drafting tape the same size and shape of the two clamp surfaces should be cut out with scissors or knife. The disks are then glued or cemented to the clamp.

Part of our clamps have been treated in this manner for some time now. The students seem particularly partial to them. There has been no tendency for the drafting tape to come off.

CABINET DRAWING

W. W. STURTEVANT

(*Continued from page 175, April, 1944 issue*)

The exercises may be drawn in pencil and need not be dimensioned, or if it is desired to place the dimensions on them this can be done later after the subject of dimensioning has been discussed.

Drawings should first be made of blocks in which all edges are horizontal or vertical. See Plate 1. The four blocks may be drawn in light lines as if all were of regular outline, and then lines drawn to show the shape of the different blocks.

The second plate may show blocks having sloping lines as illustrated in Plate 2. All of these blocks should be of the same thickness.

Following these plates, drawings should be made of blocks of different thickness but having straight lines. See Plate 3.

Two methods may be used here. The block may be thought of as being built up from a small piece or as being cut down from a large piece. See Figure 9.

The first method is similar to that used by the carpenter, while the second is that used by the sculptor.

Plate 4 shows blocks having sloping lines. The blocks are the same length but are of unequal thickness. These sloping lines do not slant at any definite angle but are drawn by connecting two given points.

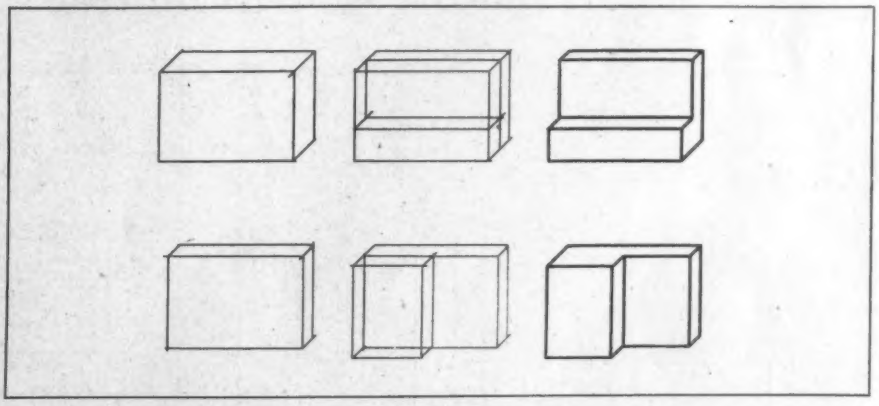


Fig. 9

(*To be continued*)

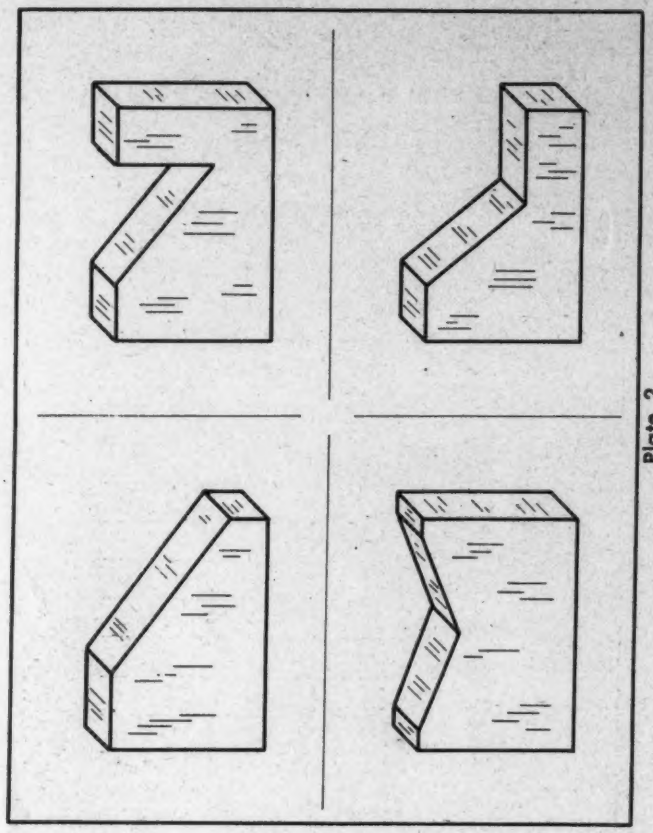
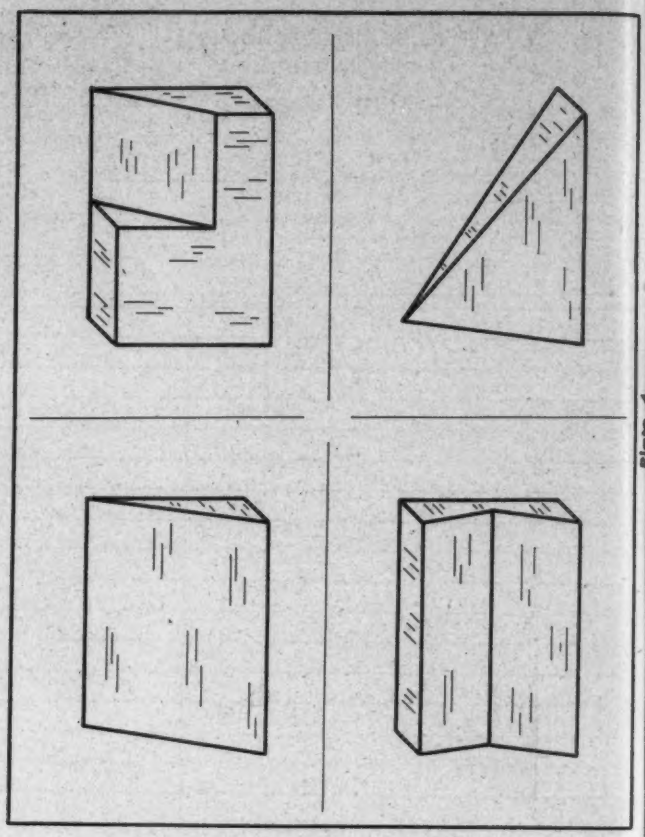


Plate 2



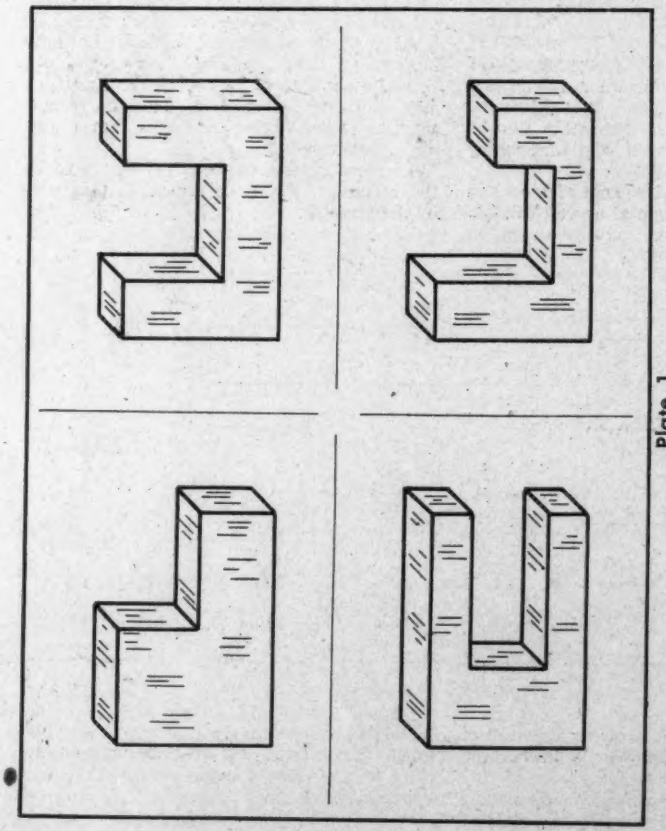


Plate 1

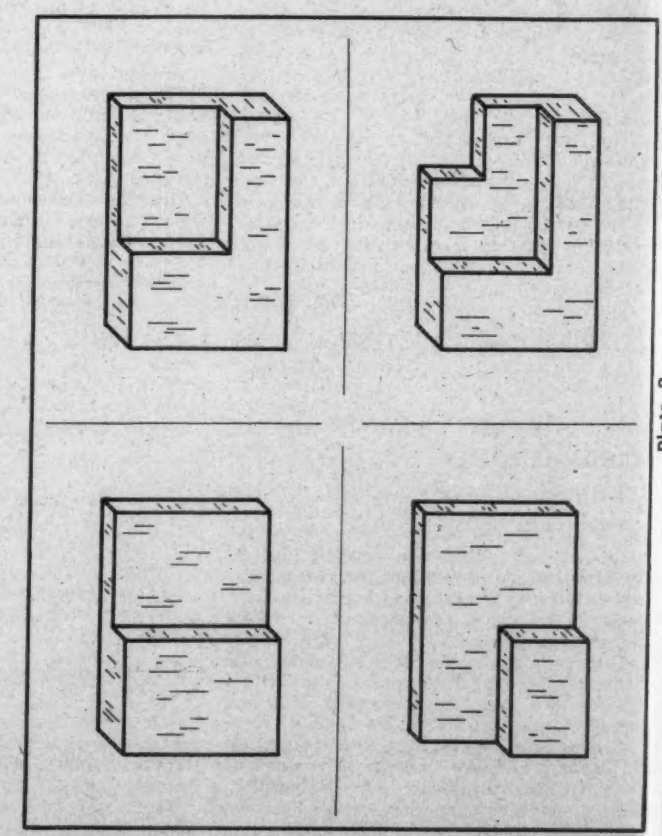


Plate 3

DISSTON *QUALITY TOOLS* are standing the test of time!

The Disston tools which so many manual training instructors bought for their school workshops are proving a most judicious and foresighted investment. Nowadays, when tools are hard to get because of war needs, students and teachers alike appreciate the long-lasting quality and continued good service of their tools by Disston.

Such tools, skilfully designed and made of fine Disston Steel, are built to withstand beginners' rough usage—and by their excellent performance they encourage better craftsmanship and rapid progress.

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HENRY DISSTON & SONS, INC., 538 Tacony, Philadelphia 35, Pa., U. S. A.

Personal News

♦ ARTHUR G. MCCREARY, director of the Beloit Vocational and Adult Education School for approximately thirty years, has presented his resignation to the members of his Vocational School Board at their session in February. His resignation will be effective August 31.

Before he entered the educational field, Mr. McCreary had practical experience in the carpentry, machinist's, and toolmaker's trades, and had been associated with engineering firms as sales representative and in conducting machinery demonstrations. This experience he gained while working for such firms as Allis Chalmers, West Allis, Wis., the Gisholt Machine Co., and Steinle Machine Co., at Madison, Wis., and Fairbanks, Morse & Co., in Beloit, Wis. His education in engineering, and his experience in teaching and administration was obtained at several colleges.

He has been active both in educational groups and in civic affairs. He is a past president of the Wisconsin Vocational Directors' Association, and holds memberships in the Wisconsin Educational Association, the Beloit Educational Association, and the American Vocational Association. He is a past president of the Kiwanis club, and his civic interests include the Boy Scouts organization for which he served as an executive committeeman. He is a member of several war committees in Beloit.

♦ G. F. LIEBENDORFER, superintendent of schools at Sidney, Neb., for the past 21 years, has been named director of the Nebraska state department of vocational education. He succeeds Sidney Owen, director for the past four years, who has resigned to accept a position with the visual education division of the U. S. office of education. Owen has been with the department for 15 years.

Mr. Liebendorfer was born in Pawnee City and is a graduate of the university. He has been an instructor at Chadron college and the university, and first started his teaching career in the first junior high school in Lincoln. Mr. Liebendorfer has built the vocational education course at Sidney into one of the finest in the state and is a recognized leader in the field.

♦ LT. R. RANDOLPH KARCH, USNR, was recently appointed Officer-in-Charge of Publications at the Naval Air Technical Training Center at Navy Pier, Chicago. He is on military leave of absence as principal of the High School of

Lt. R. Randolph Karch

Graphic Arts and Printing, Cincinnati, and served on the teacher-training staff at the Pier before taking over his new duties.

♦ BRUNO R. NEUMANN, until recently senior economist with the Planning Division of the War Production Board, has joined the National Foremen's Institute, Inc., Deep River, Conn., as labor economist and editorial director. He will make his headquarters at the company's editorial office, 527 Fifth Ave., New York City. Mr. Neumann will head up the Institute's research and consulting service on labor economics and labor relations. *The Foreman's Letter* and the *Executive's Labor Letter* will be under his editorial direction.

♦ EUGENE HEUER, former assistant to A. A. Kvorning in his work as supervisor of war-production training at St. Paul, Minn., was appointed co-ordinator of the Vocational School and also supervisor of war-production training.

♦ MILTON ELLISON, formerly at Battle Creek, Mich., high school, has been appointed co-ordinator in the cooperative business training program in Battle Creek.

♦ GLEN RICE who has been the co-ordinator at the Battle Creek, Mich., high school for several years, has been appointed co-ordinator of the retail training program at Western Michigan College of Education.

♦ TIM JOHNSTON has been appointed co-ordinator of the cooperative business training program in Midland, Mich. He was formerly a related subjects teacher on the cooperative program. Mr. Johnston replaces Robert Davies who has resigned to accept an executive position with the Boy Scouts of America.

♦ ALLEN WHITNEY has been made co-ordinator of the cooperative office training program at the Wilbur Wright Vocational high school in Detroit, Mich.

♦ HOWARD L. SHERMAN, former Rehabilitation Field Agent in Grand Rapids, Mich., was inducted into the armed services in December and is assigned to Fort Sheridan, Ill.

♦ OTTO BAKER, former director of the Menomonie, Wis., Vocational School, is receiving his officers training in the navy at Princeton University.

(Continued on page 26A)

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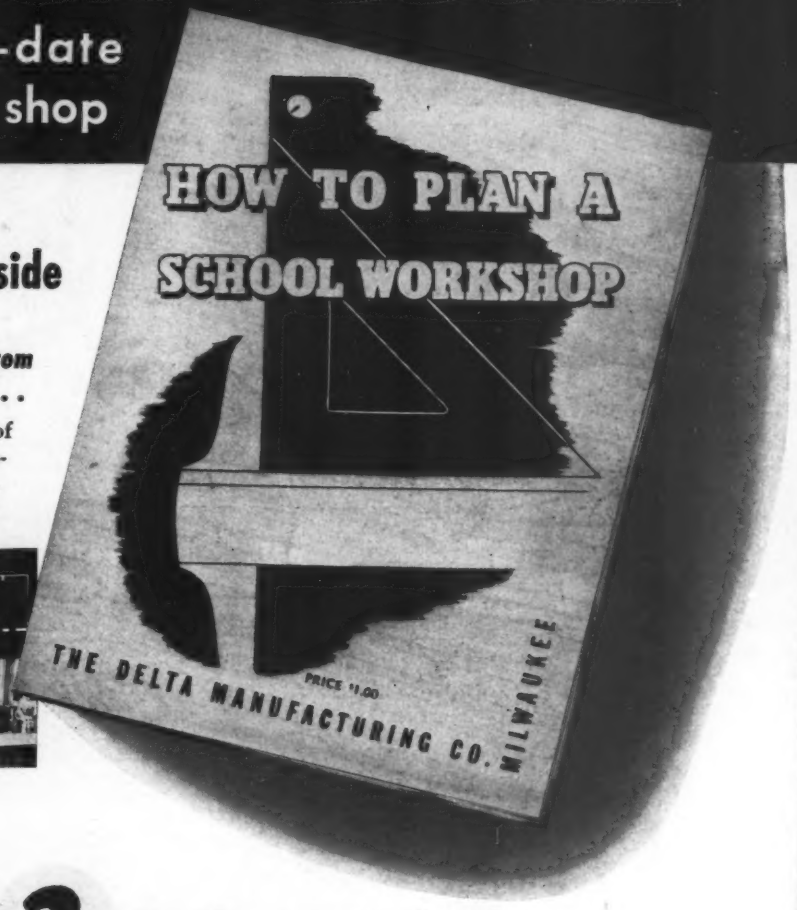
2 Free Delta Books

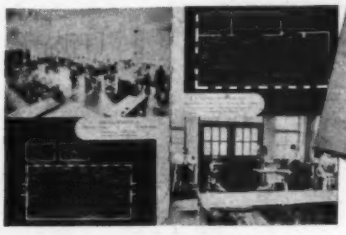
help you keep up-to-date on equipping the school shop

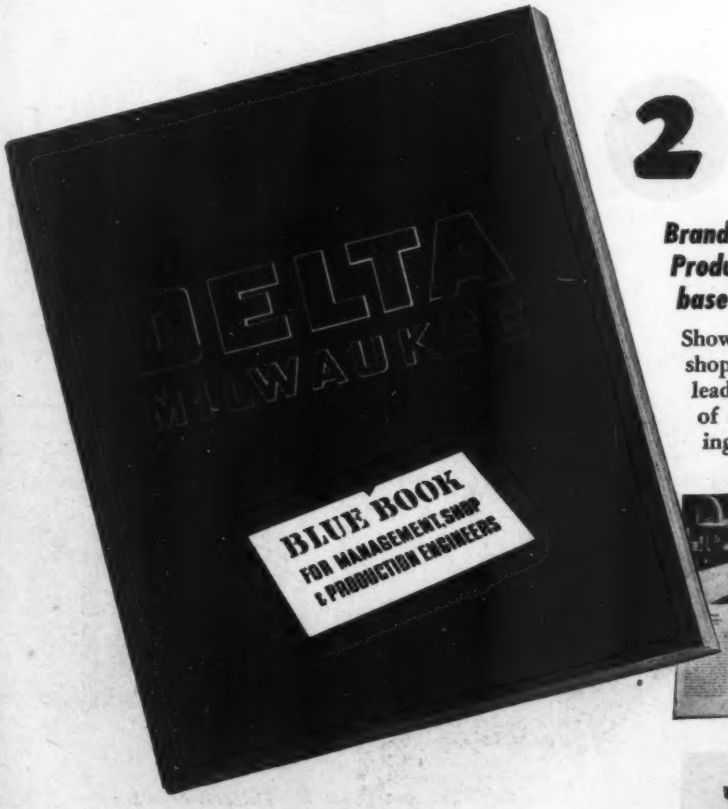


1 On the professional side

"How to Plan a School Workshop"— 30 plans from a nation-wide competition conducted by Delta . . .

Not Delta's plans — but the winners among hundreds of plans submitted by the teaching profession. Actual photographs and layout drawings, for schools large and small. Also condensed guide to selection, placement, and efficient use of the major power tools. 44 pages of authentic information from the standpoint of safety, convenience, teaching efficiency. Ask for your copy — it's free.





2 On the practical side

Brand-new "Blue Book for Management, Shop, and Production Engineers"— 140 latest case histories based on war-production tooling . . .

Shows how closely your use of Delta tools in the school shop is tied up with the latest practices in the nation's leading industrial plants. Not only are many thousands of standard Delta tools in use in production lines, but ingenious production engineers have used them as components of the special-purpose machines illustrated and described in this book—saving valuable time in tooling up and also making an enormous cost saving. 76 pages. Use coupon on next page for your free copy.

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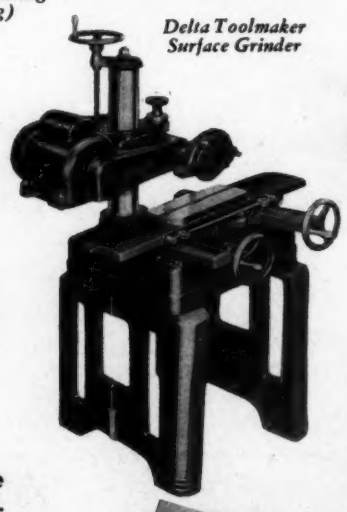
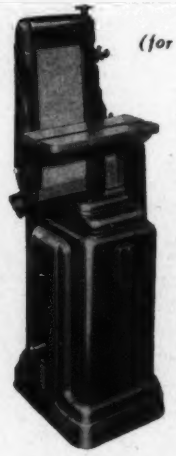
Delta Toolmaker Surface Grinder



Delta Industrial Grinder with safety shields



Delta Abrasive-Belt Finishing Machine

Delta Abrasive Disk Finishing Machine

Delta 12" Woodworking Lathe

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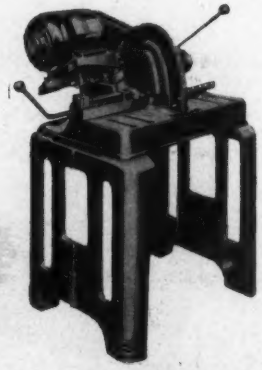
Consult your Delta Distributor



Delta Non-Ferrous Cut-off Machine (also Abrasive Wheel model)

Send for the Delta catalog of low-cost machine tools illustrated above. Also get your copies of "How to Plan a School Workshop" and "Blue Book for Management, Shop, and Production Engineers," described on preceding page. Tear out and mail coupon.

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- ☐ Catalog of low-cost Delta machine tools.
- ☐ Blue Book for Management, Shop, and Production Engineers.
- ☐ How to Plan a School Workshop.

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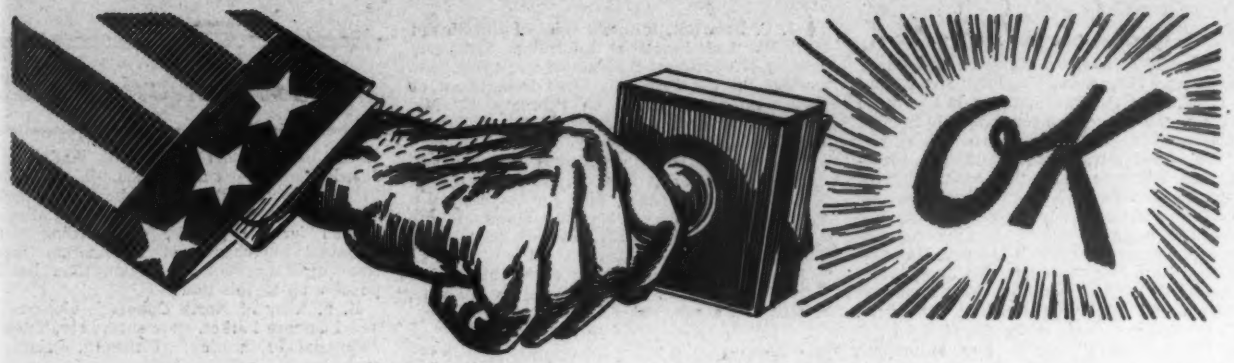

What Better Proof Could Be Asked For?

When Uncle Sam put his O.K. on the School Training program, it was done for one main purpose.

And that purpose was — TO HELP WIN THE WAR!

The war is not yet won — in fact, the hardest part lies ahead.

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Time is important—lost days can take their toll in lives of men on the fighting front—don't delay checking your new Brodhead-Garrett catalog and ordering what you need NOW. We'll see that your order gets the very best possible attention and service.

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"Supplying Defense Training Needs to Schools in All 48 States"

CLEVELAND, OHIO

(Continued from page 22A)

♦ C. M. Miller, director, Kansas State Board for Vocational Education, Topeka, Kans., and other members of the staff of the state board are conducting conferences on educational training and placement of demobilized men and women from the armed services, and retraining, placement, and adjustment in the community of returning people who have been dislocated because of their work in some war activity. These conferences are being sponsored by the superintendents of Kansas schools in Wakeeney, Hutchinson, Dodge City, Holton, Beloit, and Neodesha.

♦ Donald K. Beckley, on leave from Rochester Athenaeum and Mechanics Institute, Rochester, N. Y., is employed as an instructor at the U. S. Naval Flight Preparatory School at Monmouth College, Monmouth, Ill. Among the subjects taught to prospective Navy fliers at this institution are physics, engines, theory of flight, and mathematics.

♦ J. C. Beswick, formerly chief of the Bureau of Trade and Industrial Education, and state director of vocational training for war-production workers for the California State Department of Education, passed away on February 17. Mr. Beswick had been a member of the California State Department for over 25 years.

♦ George Elleson, mechanical drawing and drafting instructor at Boys' Trade and Technical High School, Milwaukee, Wis., for 31 years, died recently at his home after a short illness. He was born in Milwaukee and took his school and college studies in that city.

Mr. Elleson was a member of the Milwaukee Schoolmasters' club. He is survived by his wife, a daughter, a son, and a brother.

"We must help our young people to participate in the culture of the world and make a curriculum from their needs."
— *R. L. Cooley*

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Association News

♦ At the Regional Meeting of Trade and Industrial Supervisors at Chicago, Ill., on February 22, the Central Regional Association of State Supervisors was organized. The association was formed for the purpose of affording a more complete interchange of information between state supervisors of the region than has been possible up to this time.

E. F. Riley of North Dakota is vice-president, and Laurence Parker, state supervisor, Trade and Industrial Education, Pittsburg, Kans., is secretary.

♦ The Michigan Vocational Association will hold its first state-wide convention with headquarters at the Pantlind Hotel, Grand Rapids, Mich., on May 11, 12, and 13. This state-wide vocational education conference will be attended by superintendents with vocational programs, directors of vocational education, directors of war training, supervisors, co-ordinators, and teachers of vocational education. All exhibits will be housed in the civic auditorium adjoining the hotel.

The Michigan Industrial Education Society will hold its annual convention sectional meetings starting Friday, May 12, with a general session at 9:30 a.m., at the same place.

♦ The main address at the February meeting of the Industrial Arts and Vocational Education Society of St. Louis, Mo., was given by Mr. Joseph Chapman, director of personnel, Division of the Curtiss-Wright Co., Airplane Division, St. Louis, Mo.

Mr. Chapman's informative talk explained the actions and policies of the Curtiss-Wright Company in their dealings with skilled, semiskilled, and unskilled Negro workers, thus clarifying many rumors being circulated by some who do not possess accurate information.

After clarifying the policies of the company, Mr. Chapman stressed the importance of industrial arts and vocational education in the public schools, for work now necessary in an "all-out" war-production effort, and also for the many skilled jobs in the postwar world.

The Industrial Arts and Vocational Education Society will long remember this talk as one supporting their urgent plea for all parents, school administrators, and the general public to give industrial arts and vocational education its proper place in the school system.

News Notes

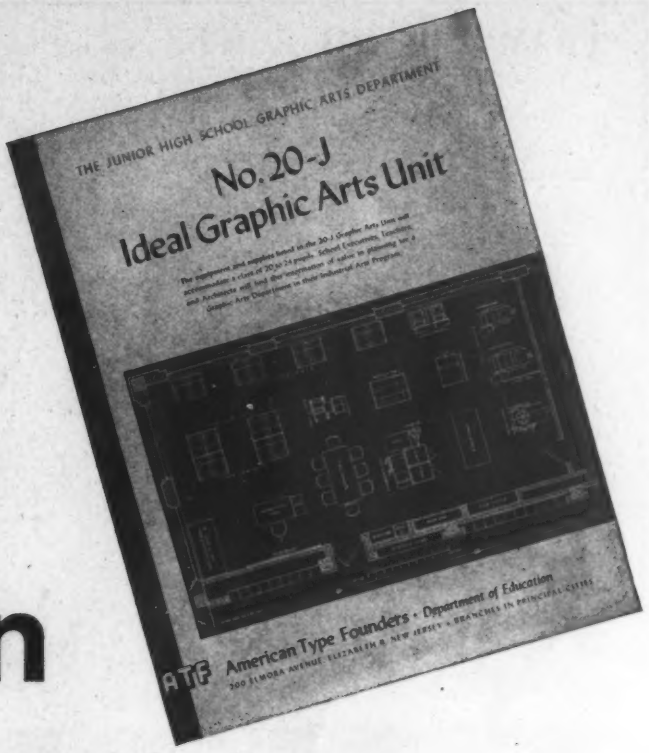
♦ L. H. Dennis, secretary of the American Vocational Association, in a recent newsletter, makes the following statements:

"Government authorities and Congressional leaders are becoming very active in the discussion of plans for the disposal and utilization of surplus government-owned machine tools and equipment. We have had several conferences with members of Congress, representatives of the Machine Tool Builders' Association, government officials, and others, relative to this matter.

"We believe it is essential that our state and local vocational leaders begin to make an analysis at once of their machine tool and equipment needs. These should be prepared in the form of lists of needed machine tools and equipment. All city directors of vocational education should work in close cooperation with the state board for vocational education, as the recommendations of the state vocational staff may have considerable bearing in securing with less delay some of this equipment when available for distribution. This may be sooner than we realize."

♦ Returning soldiers, ex-warworkers, students, teachers, parents, counselors, and others who want to know about professional opportunities

(Continued on page 29A)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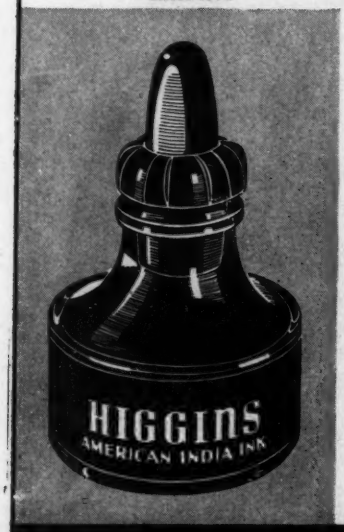

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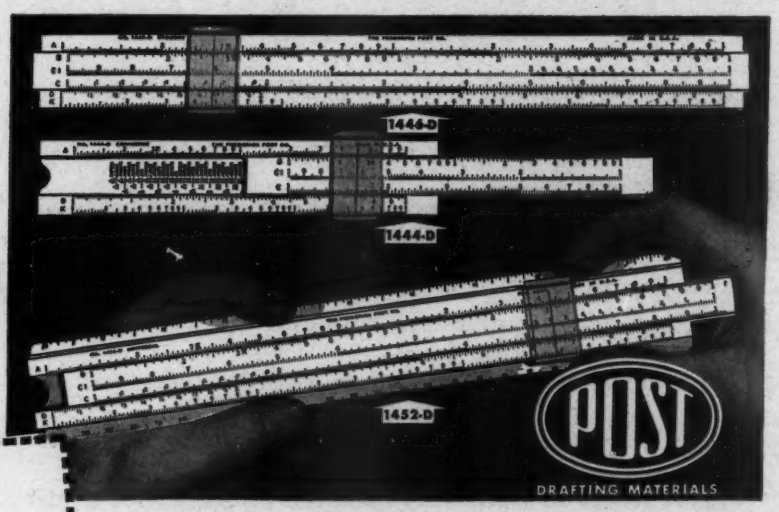

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14444D. Five inch Celluloid Face POCKET style slide Rule. Scales A, B, C1, C, D and K on slide front. Scales S, L and T on reverse. Leatherette Pocket case. *List Price $2.25.*

1446D. Ten Inch Printed surface slide rule. Inches and metric rules on vertical sides. Scales A, B, C1, C, D and K on slide front. Scales S, L and T on reverse side. In attractive leatherette case. *List Price $1.50. Subject to special education discounts.*

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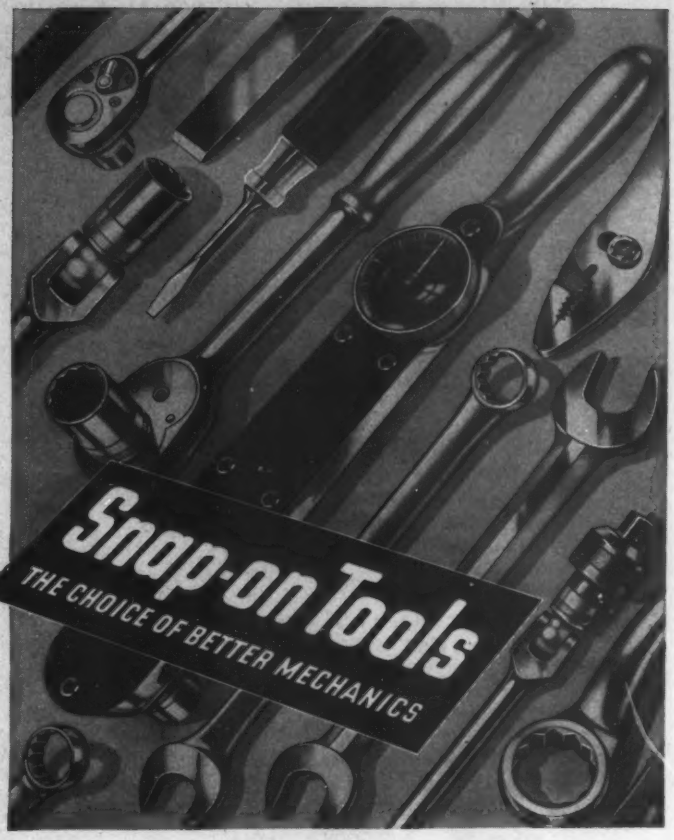
8074 E. 28th Avenue Kenosha, Wisconsin



CORRECTION

The accompanying table is to replace Table I shown on page 127 of the March, 1944, issue. The present table shows a beter arrangement and contains the correction of an error that inadvertantly crept into the one published in the March issue.

The elongations listed are those which occurred in a bar that was 100 in. long. They are, therefore, not to be looked upon as elongations per inch.

Wrought Iron Bar 100 in. long 1 sq. in. cross section		
Load in pounds	Total elongation in inches	
5,000	.02	In the range between 5,000 to 25,000 lbs., the elongation is proportional to the load. There is no permanent set when the load is removed. The allowable unit stress (about 12,500 lbs. per sq. in.), is about 1/2 of the elastic limit, and 1/4 of the ultimate strength. This represents a factor of safety of 4, which is what the designer would use where a steady load is involved.
10,000	.04	
15,000	.06	
20,000	.08	
25,000	.10	
25,000	Elastic limit	The elongations increase more rapidly than the loads.
30,000	.5+	Elongation (highly variable in a long piece) increases, resulting in permanent stretch. Material is injured but does not break.
40,000	8. +	
50,000	20 to 30	
50,000	Ultimate strength -- bar ruptures or breaks.	

Table I

News Notes

(Continued from page 26A)

in helping injured persons to re-establish themselves economically will want to read the composite summary of available literature on "Vocational Rehabilitation as a Career" just completed by Sarah Allen Beard and published by Occupational Index, Inc., New York University, New York 3, N. Y. Single copies are 25 cents cash with order.

This is the fourth in a new series of Occupational Abstracts, covering occupations in which postwar employment prospects are good. The editor of the series is Professor Robert Hoppock of New York University. Advance orders for the next 10 in the series may be placed now at $2.50.

♦ A four-volume report of a Congressionally sponsored survey on higher education among Negroes has recently been published by the U. S. Office of Education. The report covers the matter of restricted opportunities for education among Negroes, the economic and social factors growing therefrom, the resultant loss in man power, particularly for the armed forces and industry in wartime, and recommendations for action. The report includes "Socio-Economic Approach to Educational Problems" (Volume I), 40 cents; "General Studies of Selected Colleges for Negroes" (Volume II), 30 cents; "Intensive Study of Colleges for Negroes" (Volume III), 30 cents; and a "Summary" (Volume IV), 15 cents.

Copies of this report may be purchased from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

♦ The Chicago Public School War Production Program under the direction of Philip L. McNamee is making a poster appeal to men and women who can spare a few hours in the evening to learn a special skill needed in a war plant. Class hours are from 6:00 to 10:00 p.m. every evening except Saturday and Sunday. The program is financed by the U. S. Government through the State Office of Public Education, and in turn through the Chicago Board of Education.

The courses now in session cover machine operation, learning to operate a lathe, drill press, milling machine, etc.; radio, repair and construction; automobile, repair and maintenance; aviation engines, repair and maintenance; inspection of machine parts; blueprint reading; welding, electric arc.

♦ Co-ordinator-instructors of cooperative part-time retailing and office practices programs will have the opportunity of summer school work at Kansas State Teachers College of Emporia, Kans. A two-credit course in "Organization and Administration of Vocational Distributive Education and Office Training" will be given by Warren G. Meyer, state supervisor of distributive education, and H. D. Shotwell, co-ordinator-instructor of office practices at Topeka, Kans. Mrs. Flora T. Young will be the instructor in a second two-credit course entitled "Methods in Distributive Education." Classes for the first four weeks' session will begin May 29. The work will be of a practical nature so that students may put into practice next fall the materials which have been worked out.

♦ New night school classes embracing pre-induction training courses have been started at the new Topeka, Kans., trade school, and will be held from 6:30 to 9:30 on Tuesday and Thursday nights. These preinduction classes include courses in field photography and darkroom techniques, radio code, machine shop, arc and gas welding, and radio mechanics.

♦ Men are urgently needed to conduct inspections in business establishments to determine compliance with Fair Labor Standards Act, it was announced by the U. S. Civil Service Commission. Two years of responsible business experience is required, or graduation from a college with a major in either accounting or law.

(Continued on next page)

(Continued from previous page)

Positions pay $225 a month for a 48-hour week. Appointees must be willing to work anywhere within the states of Illinois, Indiana, and Wisconsin.

Applicants should visit or write to the U. S. Civil Service Commission, Room 1048, New Post Office Building, Chicago 7, Ill.

♦ The twenty-fourth annual observance of National Boys and Girls Week is scheduled this year for April 29 to May 6 inclusive.

The rise in juvenile delinquency, and the wartime dislocation of the normal life of boys and girls, have created problems for youth that make it evident that more assistance is needed now than was necessary in times of peace. The activities of the week are designed to bring to the attention of the community the problems, interests, and recreations of its youth, and also the youth-serving organizations which labor for the development of good citizenship and character in growing boys and girls.

♦ The Jam Handy Organization, 2900 E. Grand Blvd., Detroit 11, Mich., announces the completion of the following slide film kit sets. These sets are immediately available.

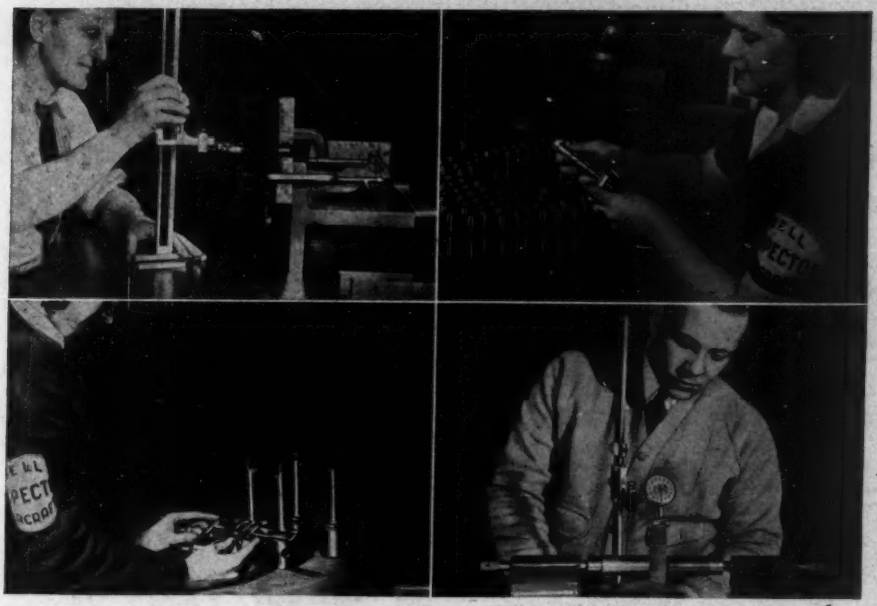
Light on Mathematics: 24 subjects, totaling 1087 individual photographs, drawings, graphs, diagrams, and pictorial exhibits.

Air-Age Physics (Mechanics): Series of 15 slide film subjects, comprising a total of 846 individual pictures.

Mechanical Drawing and Drafting: (Supplementary aids) kit set of 18 subjects, 1112 individual pictures, covering basic and more advanced geometric constructions, mechanical drawing projects, and an appreciation of the uses to which drawings are put in the shop.

♦ A test program to record properties of laminated materials, and to standardize specifications and determine "best use" applications has just been established at Johns Hopkins University, Baltimore, Md. It is a wartime development which is conceivably projected for possible permanent establishment.

The testing program originated when a number of manufacturers united in providing facilities for the tests in the Johns Hopkins School of Engineering, and to facilitate the collection of concrete facts about laminates as applied to the wartime aircraft field.



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Conversion of willing but untrained hands into the sensitive, capable hands of skilled machinists has been a service to our Country that cannot be overestimated.

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Starrett Tools will continue to be worthy of the skill and confidence that you have taught and are teaching a great new generation of fine tool users to respect and appreciate.

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New Publications

Elements of Blueprint Reading

By H. B. Cobaugh. Paper, 67 pages, 8½ by 11 in. Price, 72 cents. Published by The Bruce Publishing Co., Milwaukee, Wis.

A brief course combining visualization and sketching. The author of this book believes that the ability to visualize an object from a drawing (blueprint reading) is most easily developed by one who knows how to make a drawing of that object himself.

The sketching, throughout the course, is done directly on the plates showing pictorial representations of objects, and there also are spaces in which various answers to questions may be written.

Tests are interspersed among the various units. The last unit is based entirely on working drawings from industry.

Aircraft Sheet Metal Work

By Clarence A. LeMaster. Cloth, 388 pages, 6¼ by 9⅜ in., illustrated. Price, $3.75. American Technical Society, Chicago, Ill.

A textbook to be used in training beginners and apprentices in the aircraft sheet-metal work. The author, who has taught many beginners in this subject, starts out by giving the student a list of safety precautions so that he may learn to work safely from the very start. Then the tools used by the aircraft sheet-metal worker are described and their uses explained, after which the student is introduced to blueprint reading. Then follow chapters on template layout, pattern developments, riveting, skin fitting, general fabrication, soldering, brazing, welding, assemblying, repairing, and information about the various materials used in aircraft construction.

The book may also be used as a reference by experienced mechanics in the trade.

Engineering Drafting Problems

By Kenneth E. Quier. Paper cover, 8¼ by 10¾ in. Price, $2.50. Harper & Bros., New York City.

A set of drafting plates which can be used with any textbook. The plates cover the elements of engineering drafting, and the professional phases of drafting met in the mechanical, civil, chemical, and electrical engineering fields.

A good grade of drawing paper has been chosen for the plates so that the student can make the necessary graphical solutions directly upon them.

Exploring the Industries

By Chris H. Groneman and E. L. Williams. Paper, 160 pages, 8½ by 11 in., illustrated. Price, 70 cents. The Steck Co., Austin, Tex.

The authors of this book present a conducted tour through the various industries to the student, explaining to him by word and pictures what men do to earn a livelihood.

The occupations studied cover those of the draftsman, the woodworker, metalworking, forging, sheet-metal worker, art metal practices, and electricity. In each of these fields, the student has an opportunity to learn by personal participation something about the materials, tools, and processes used in the respective occupations.

Maintenance Arc Welding

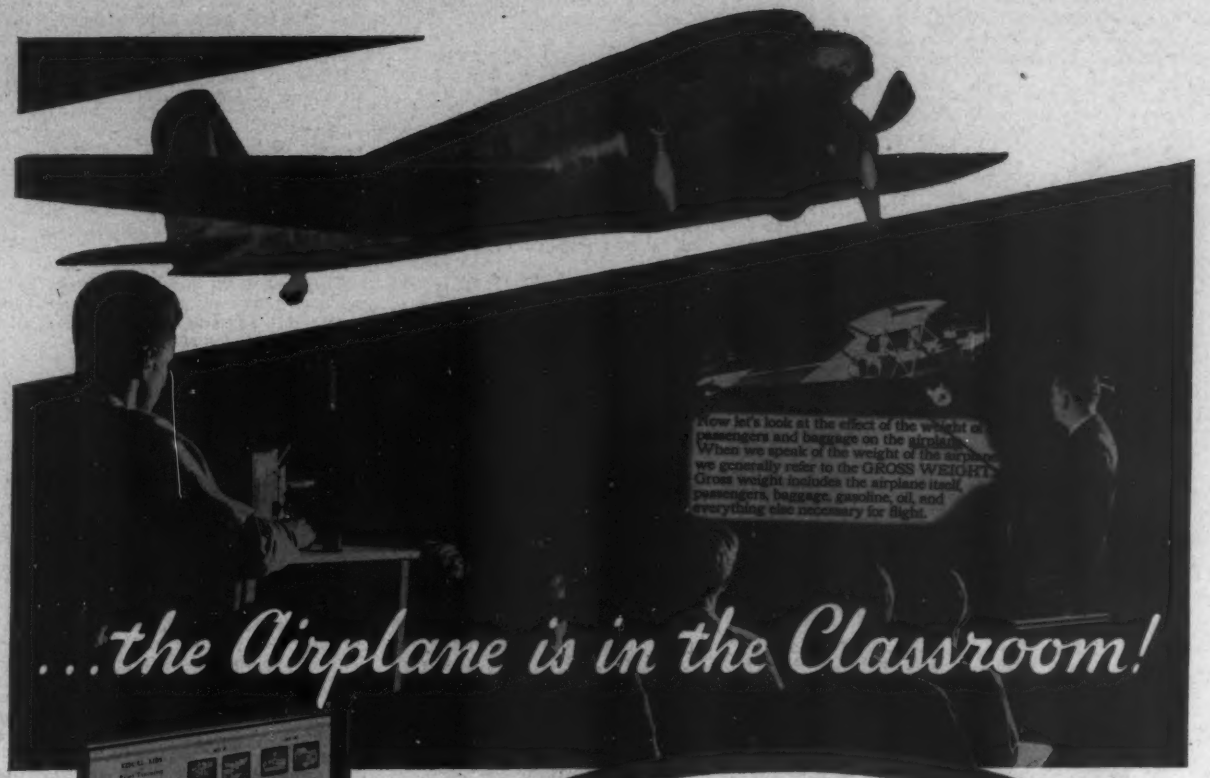
Prepared and published by The James F. Lincoln Arc Welding Foundation, Cleveland, Ohio. Cloth, 233 pages, 6 by 9 in., illustrated. Price, 50 cents in U. S. A., 75 cents elsewhere.

A symposium on the savings effected by using arc welding in maintenance jobs in a large number of plants of diverse kinds.

A Shady Hobby

By Jean Frances Bennett. Cloth, 71 pages, 7⅝ by 10¼ in., illustrated. Price, $2. The Bruce Publishing Co., Milwaukee, Wis.

(Continued on page 32A)


Now let's look at the effect of the weight of passengers and baggage on the airplane. When we speak of the weight of the airplane we generally refer to the GROSS WEIGHT. Gross weight includes the airplane itself, passengers, baggage, gasoline, oil, and everything else necessary for flight.

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(Continued from page 30A)

A title that arouses interest but which does not disclose that the author presents a charming account, and practical suggestions and rules on how to cut silhouettes.

The illustrations used in her book show her own artistry and skill, and act as a great incentive to the reader to try to learn how to do equally fine work.

Marine Coppersmithing

By Frank J. Carr. Cloth, 195 pages, 6 by 9 in., illustrated. Price, $2. The McGraw-Hill Book Co., New York, N. Y.

A helpful book for the beginner, the apprentice, and the mechanic at a trade which at present could use many more skilled workers.

The material in this book describes the tools and equipment needed in the craft, the torches and forges used by the coppersmith, how to anneal the various copper alloys, acids used for cleaning and as a flux for soldering, methods of soldering, sweating, and wiping copper, brazing, making flanges, making reducers and branches, bending tubes, making templates, using expansion joints, testing, and shipwork.

Modern Drafting

By William H. Johnson and Louis V. Newkirk. Cloth, 197 pages, 8⅜ by 11⅛ in. Price, $1.72. The Macmillan Co., New York City.

A text in drafting, covering the tools used by the draftsman, lettering, reading of drawings, the making of working drawings, freehand sketching, the making of cabinet and isometric drawings, geometric construction, sheet-metal drawing, and drafting methods used by those who make the drawings for machinists, aircraft mechanics, and workers in the building trades. The subjects of graphs, maps, tracing, blueprinting, and duplicating, are also covered.

Technical Handbook

By Edward H. Lang. Paper, 108 pages, 5¼ by 7¾ in. Price, $1. Prentice-Hall, Inc., New York, N. Y.

A book for students, apprentices, and mechanics on problem solving for shop, laboratory, and factory. It contains a review of the common arithmetical operations; the solving of problems of the triangle; areas and volumes; logarithms; graphs; the laws of gases; density and specific gravity; heat; the simple machines; energy, work and power; velocity and acceleration; properties of materials; properties of sections; d.c. electricity; chemical computations; and use of the slide rule.

You Can Make It

By Louis V. Newkirk and LaVada Zutter. Cloth, 214 pages, 7⅞ by 10⅝ in. Published by Silver, Burdett & Co., New York, N. Y.

A book filled with delightful suggestions and patterns for things that youngsters will eagerly make.

The suggestions in the book cover articles for personal adornment, toys and games, gifts and decorations, and articles for the school and home.

Illustrated Technical Dictionary

Edited by Maxim Newmark. Cloth, 352 pages, 6¼ by 9¼ in. Price, $5. Published by The Philosophical Library, New York, N. Y.

A dictionary containing technical definitions of current terms in the fields of aeronautics, mathematics, architecture, industrial arts, the sciences, mechanical trades, and industrial processes.

The Craftsman Prepares to Teach

By David F. Jackey and Melvin L. Barlow. Cloth, 184 pages, 5⅜ by 7⅝ in. Price, $2. The Macmillan Co., New York City.

A book which will help the skilled craftsman to prepare himself as a trade teacher. The content is divided into two parts. The first one is on making the course of study, and the second on factors of successful teaching.

The book is small yet comprehensive enough to be a real help to the man who is thoroughly familiar with one trade, but who is now confronted with the problem of teaching that trade to others.

Blueprint Reading

By Fred Nicholson and Fred Jones. Cloth, 141 pages, 7¼ by 10 in. Price, $2. D. Van Nostrand Co., New York City.

A very helpful book on blueprint reading in which the actual blueprint reading has been kept in the foreground, and sketching has been relegated to the subordinate position.

Machine Shop Work

By John T. Shuman, Horace H. Lowell, Lewis H. Bardo, and J. O. Corbin. Cloth, 499 pages, 5¾ by 8⅜ in., illustrated. Price, $3.50. American Technical Society, Chicago, Ill.

A very comprehensive text for the beginner who is preparing himself as a machinist or toolmaker. The material is well illustrated and gives explicit directions on how to use the common hand tools, including layout, measuring, and inspection tools; how to do chipping, filing, scraping, and hand threading; how to use drilling machines; and cut gears and perform broaching operations.

It is an excellent text for the apprentice, the student in trade and part-time and full-time trade and vocational schools, adult evening classes, and for the practical mechanic who wants to refresh his memory on things forgotten or not perfectly understood.

Vegetable Dyes

By Douglas Leechman. Paper, 55 pages, 5 by 6¾ in. Price, 35 cents. Oxford University Press, Toronto, Canada.

An interesting booklet which tells in concise terms how to prepare dyes from barks, weeds, berries, vegetables, and fruits, and having made the dyes, how to use them on wool and other fabrics.

Practical Radio for War Training

By M. N. Beitman. Paper cover, 336 pages, 6 by 9 in., illustrated. Price, $2.95. Supreme Publications, Chicago, Ill.

Written by a man who has taught the subject in the public schools and in the army, this book covers the subject matter in a very comprehensive manner.

The contents is divided into 19 chapters in which the mechanics and the mathematics of radio are explained, as are also circuits using resistors; properties of coils and transformers; properties of condensers; L, C, and R, combined circuits; how meters work; vacuum tubes; power

(Continued on page 34A)

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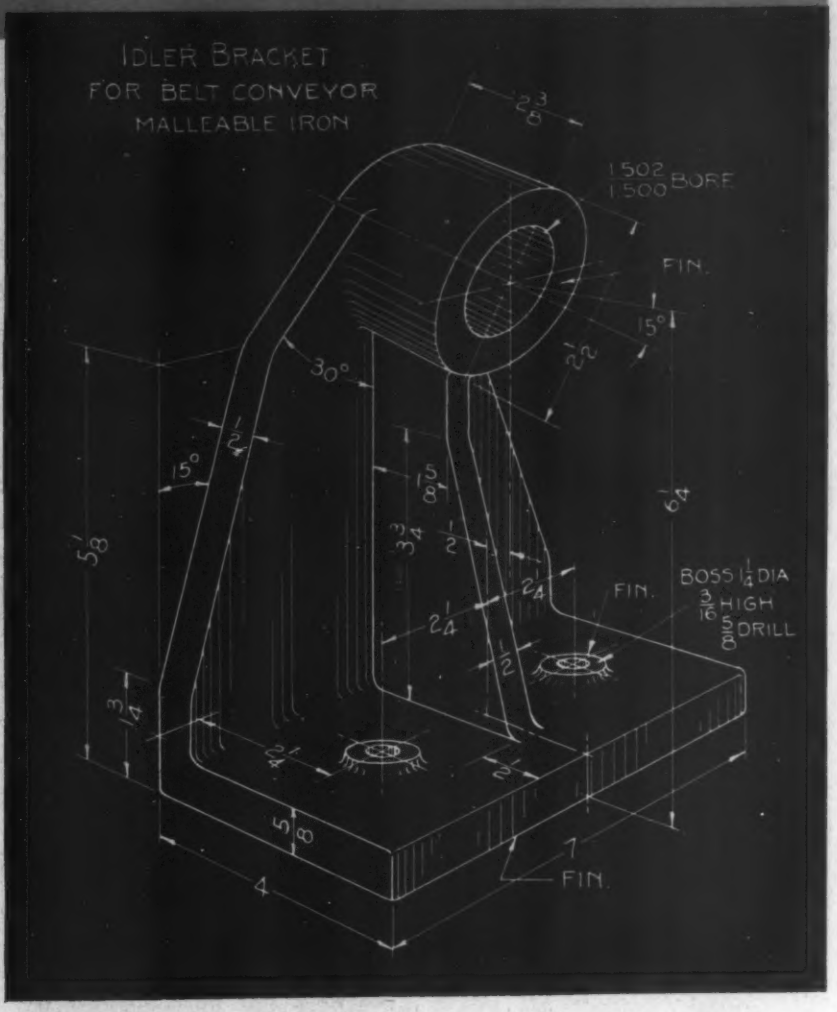

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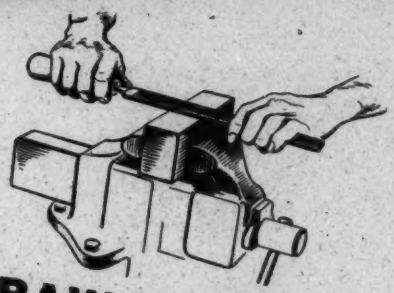

DRAW-FILING

Draw-filing may be defined as alternately pulling and pushing a file over the work in such a way that the length of the file is transverse to the direction of motion. It is employed wherever a smooth, level surface on planes or edges is desired.

As the beginner can see from the illustration, the file is held with both hands, —with the fingers on the edge away from the filer's body and the thumbs on the edge toward the body. The file is then alternately pulled toward the body, and then pushed away from the body. One advantage of draw-filing is that the file can be held steady. A fine surface finish is secured without scoring or scratching. Ordinarily a Mill Bastard File with a long angle should be used so that the metal is cut with a true shear or shaving action.

In learning to draw-file, there is a tendency to apply most of the effort when the file is in the middle of its stroke. This is likely to develop a hollow spot that must be guarded against by a careful check-up after the filing is completed.

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(Continued from page 32A)

supplies; audio amplifiers and accessories; radio frequency voltage amplifiers; detectors; receiver circuits; oscillators; radio transmitter circuits; lines, antennas, and radiation; and meter and electronic test equipment.

Occupations Today

By John M. Brewer and Edward Landy. Cloth, 377 pages, 6⅛ by 9 in., illustrated. Price, $1.64. Ginn and Company, Boston, Mass.

A book on guidance both for the war and the postwar era. It outlines a method for studying occupations and how to make use of the school to prepare for the one chosen. It also shows the part which cooperation has to play in making the worker successful in the vocation for which he has prepared himself.

Basic Problems in Descriptive Geometry

By William Wirt Turner and Carson P. Buck. Sixty sheets, 8½ by 11 in. Price, $1.75. The Ronald Press Co., New York City.

A series of 60 work sheets based on third-angle projections. The sheets will fit any standard textbook and provide drill in applying and determining true lengths, true size of planes, perpendicular relationships, piercing points, and the like.

Practical Radio and Electronics Course for Home-Study, Vols. I, II, and III

Prepared by M. N. Beitman. Price, $3.95 per set. Supreme Publications, Chicago, Ill.

A series of 53 lessons prepared for home study. The books cover the field of radio and electronics quite fully. Among the subjects covered are television, U.H.F., facsimile, ignitron, X rays, FM, radio servicing, and radio transmitters.

Manual of Aircraft Riveting

By Marvin G. Roth. Cloth, 96 pages, 5¼ by 7⅝ in., illustrated. Price, $1.25. McGraw-Hill Book Co., Inc., New York City.

A concise text on the things which the aircraft riveter must know and be able to do. In it are described the various types of rivets used, the kinds of joints, heat-treatment of rivets, types of riveting, removal of rivets, and shop hints on riveting.

Aerodynamics of the Aeroplane

By W. L. Cowley. Cloth, 201 pages, 5⅜ by 7¾ in. Price, $2.25. The Ronald Press, New York, N. Y.

A concise text giving the student a general knowledge of the principles underlying the subject of aerodynamics.

The book covers the airfoil, the propeller, the plane in steady flight, aerodynamic measurements in model and full-scale tests, airfoil theory, fluid motion, and vibrations in aircrafts.

Applied Mathematics for Technical Students

By Murlan S. Corrington. Cloth, 226 pages, 5¾ by 8⅝ in. Price, $2.20. Harper & Bros., New York, N. Y.

A mathematics text for those aiming to prepare for entry into industrial fields. It presents a combination of the theoretical and the applied.

It presents a review of the fundamentals of applied arithmetic, simple algebra, logarithms, quadratic equations, simultaneous equations, and practical applications of trigonometry.

The Manufacture and Fabrication of Steel

By Ernest J. Teichert. Cloth, 487 pages, 5½ by 8½ in., illustrated. Price, $4. McGraw-Hill Book Co., New York, N. Y.

This is Volume II of a three-book series prepared for training those who are about to enter the iron and steel industry, or are preparing themselves for one of the engineering professions.

The book covers in quite a comprehensive technical manner the various methods used for making and fabricating steel, making wire and tubular products, and the welding, forging, and foundry processes.

Teacher's Manual

By Nicholas Moseley. Cloth, 208 pages, 5¼ by 7⅜ in., illustrated. Price, $2. Cornell Maritime Press, New York City.

This book is designed to help those who have to act as instructors in giving military, marine, vocational, and industrial training.

The book is divided into two parts, covering teaching methods and practices. It also contains a list of selected references.

Your Share

By Betty Crocker. Paper, 48 pages, 5⅜ by 8 in. Prepared by the Home Service Staff of General Mills, Inc., Minneapolis, Minn.

This booklet contains 52 menus, 226 recipes, and 369 hints on how to make our food supplies extend farther.

Suggested Shop Problems for Hand Skill Practice in Air Craft and Sheet Metal Work

By I. D. White. Paper cover, spiral, 100 pages, 8½ by 11 in. Price, $3.75. The Metal Crafts Guild, Brooklyn, N. Y.

This book contains general directions on blueprint reading and drafting; describes how to use the hand and bench tools which the sheet-metal worker uses; and presents numerous sheet-metal projects for layout, forming, drilling, riveting, and assembly practice.

The book also presents a number of problems in sheet-metal pattern development.

Ten Lessons on Meat for Use in Schools

Prepared by National Live Stock and Meat Board, Department of Home Economics, 407 E. Dearborn St., Chicago, Ill.

The booklet contains 148 pages, 5⅞ by 8⅞ in., illustrated. Price, 10 cents.

BOOKLETS AND PAMPHLETS

Women's Work and the War

By Mary Elizabeth Pidgeon. Occupational Monograph No. 36. Science Research Associates, 1700 Prairie Ave., Chicago, Ill.

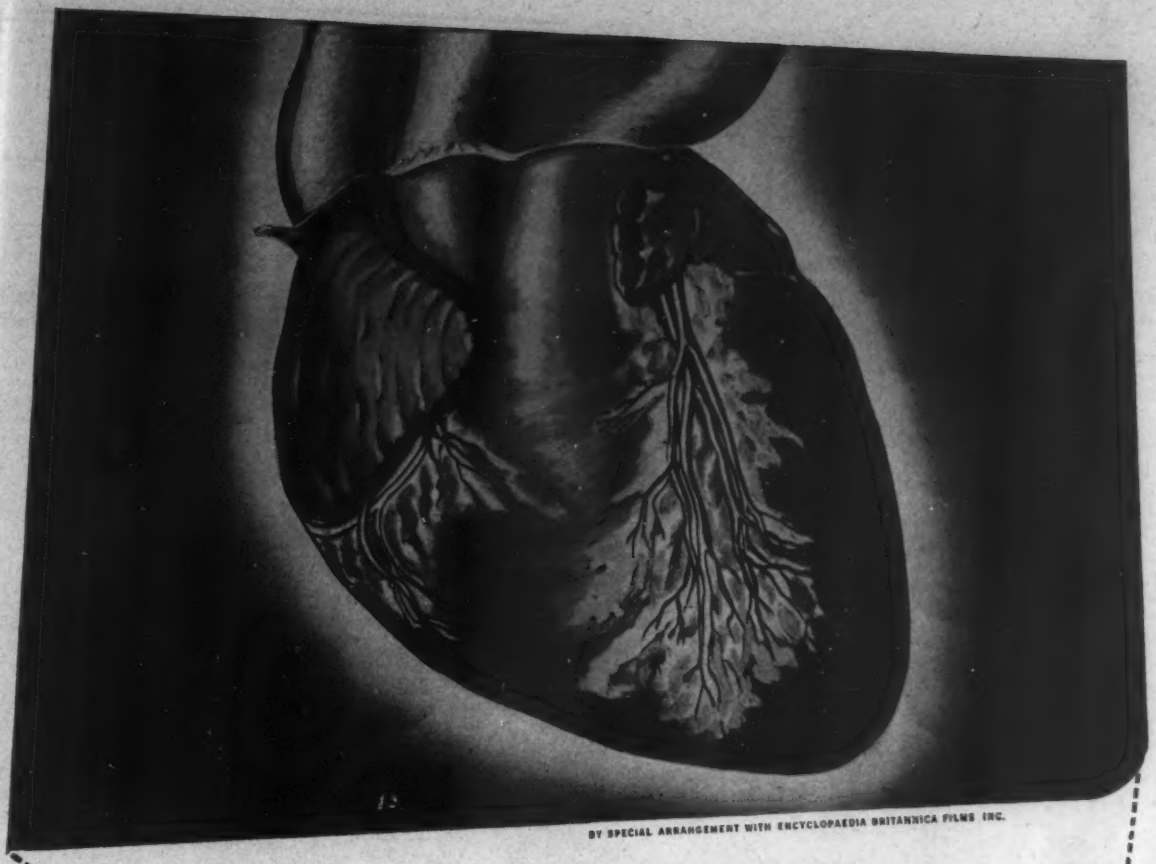
Crafts for Convalescents

By the Chicago Public Schools Industrial-Arts Department. The booklet is sponsored by Gray Lady Hospital and Recreation Corps, Chicago Chapter, American Red Cross.

Steel Products Manual

By the American Iron and Steel Institute, 350 Fifth Ave., New York City. Price, $2.50.

(Continued on page 36A)



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(Continued from page 34A)

Understanding Juvenile Delinquency, Publication 300 and Controlling Juvenile Delinquency, Publication 301

These are U. S. Department of Labor publications, and may be obtained at 10 cents each from the Superintendent of Documents, Washington, D. C.

Safety Education in the School Shop

A 56-page pamphlet published by the National Safety Council, Inc., 20 North Wacker Drive, Chicago, Ill. Price, 50 cents.

The Teacher of Mathematics and the War Savings Program

A 38-page pamphlet for elementary and high school classes in mathematics and business arithmetic. This material is obtainable in quantities from the State War Finance Offices, or from the Education Section of the War Finance Division, U. S. Treasury Department, Washington 25, D. C.

Shop Equipment News

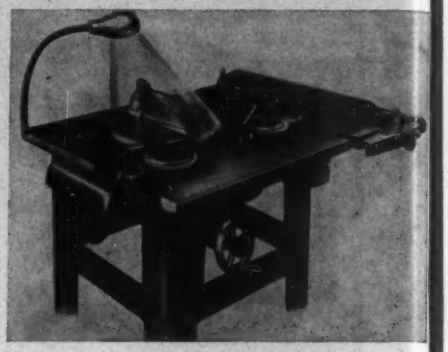
New Products — Publications

IMPROVED UNIVERSAL SAW

An improved model of the Wallace No. 11 Universal Saw which can accommodate extension tables providing ripping capacities of 24, 36, or 48 in. is now available.

These larger extension tables are designed to handle the sawing of large plywood panels.

They also facilitate ripping assembled material to accurate width after assembly, as in the case of tongue and groove material used in the manufacture of export boxes for the army and navy.



Improved Universal saw

Tongue and groove stock does not always run accurately in width and also may not pull together uniformly to over-all size. With the new extension tables on the Wallace No. 11 Saw, such material is first put together and then ripped to the desired size.

The No. 11 Universal Saw is available with one or two h.p., single- or three-phase motors, geared to offset the spindle and provide a 3-in. depth of cut with 9-in. diameter blades, and 4-in. with 11-in. blades. The motor tilts for bevel work, the table remaining in a horizontal position. Manufactured by J. D. Wallace & Co., 140 S. California Ave., Chicago, Ill.

For brief reference use IAVE—510.

A VERSATILE WOOD LATHE

The deep gap bed of a new lathe offered by Boice-Crane Co., 974 Central Ave., Toledo, Ohio, gives 50 per cent or more faceplate turning capacity than the straight bed type. This new machine has 60-in. center, 11-in. swing over bed and 17 by 3 in. over gap. There is enough distance between centers to turn a full-length lamp pedestal.

Deep-gap wood lathe

An improved indexing device permits easy layout of circular work into any number of equal divisions. The tailstock spindle is calibrated for boring operations of accurate depth.

Proper speeds for wood turning and metal spinning are permitted by the 4-step cone pulley. All boring, reaming, and milling operations are performed in a master jig.

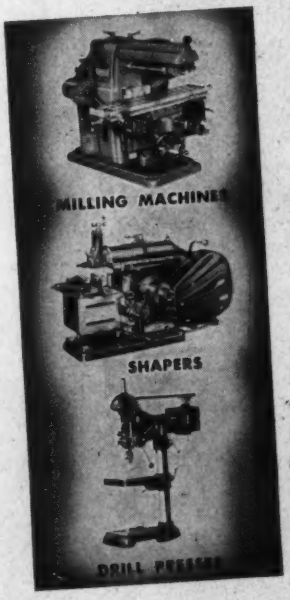
The live spindle has a hole clear through, for chucking long rods or dowels. Both spindles have No. 2 Morse taper sockets, and tailstock has a self-ejecting center feature. The lathe is quiet, smooth running, and vibrationless.

For brief reference use IAVE—511.

GAUGE BLOCKS IN INCREMENTS OF TEN MICRO INCHES

Continental Machines, Inc., 1301 Washington Ave., South, Minneapolis 4, Minn., announces the new DoAll Vernier Gauge. Up to this time gauge blocks were limited to the combination which could be made in increments of one ten thousandths of an inch. The DoAll Vernier Gauge simply and effectively extends the range of combinations of sizes which can be made with

(Continued on page 39A)



"Practically" equipped school shops will be the great need this year and in the post-war years—for broader vocational training of present students and the hundreds of returning servicemen.

Atlas tools are ideal for this purpose. Their cost is low. You can buy several machines for the cost of a single larger tool. And the training they offer is complete because they have the precision and variety of operation found in larger tools.

Although much of Atlas production goes to war plants today, delivery to schools is by no means out of the question. Ascertain your fall needs now . . . and write for latest delivery information and catalogs.

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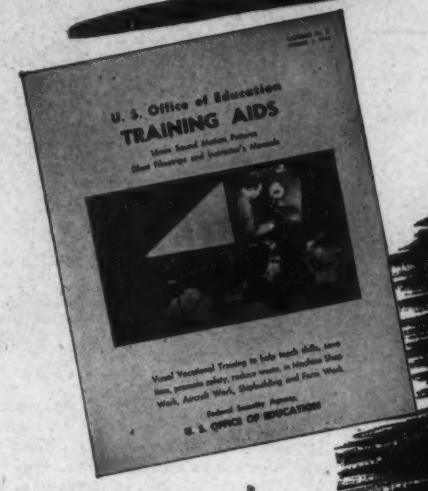

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While films are arbitrarily listed under different classifications—all industries having machine shops will find machine shop films valuable. The aircraft industry and the machine shop industries will find many of the shipbuilding films applicable to their own businesses. Shipbuilders will find that they can use many allied films. And manufacturers of farm machinery, wool buyers, and canners will find the agricultural subjects of value. All the films are part of an integrated program to help you increase efficiency and production.

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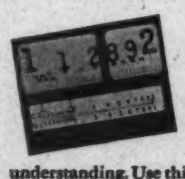

Last year, "THE MICROMETER" helped to teach thousands of workers how to use this all-important precision tool. "THE SLIDE RULE" is a companion film of equal basic importance. It helps to teach through seeing . . . through hearing. Simply. Quickly. Clearly. Animated diagrams help to give the worker a quicker understanding. Use this visual aid now for Victory! Price:

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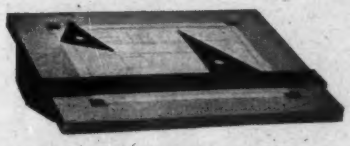

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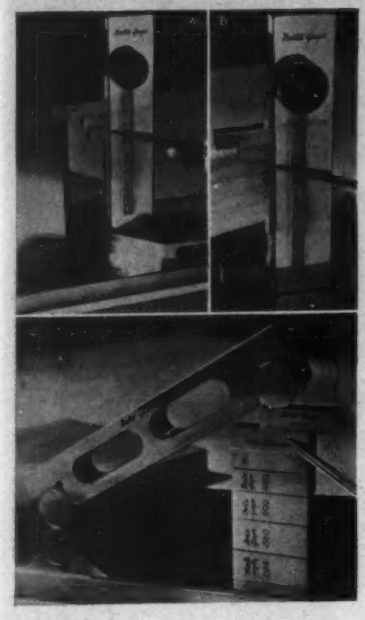
(Continued from page 36A)

any set of gauge blocks by enabling combinations to be made in steps of ten millionths of an inch and to the same degree of accuracy as provided by precision gauge blocks.



At A the gauge is shown set up as a height gauge; at B, as a snap gauge; and at C, as a gauge for measuring angles within two seconds of arc

The DoAll Vernier Gauge, while being of the highest precision, is extremely simple in construction. The gauge consists of two gauge blocks having a precision taper on their mating faces. When the taper faces of two blocks are wrung together with their taper index marks coinciding, the blocks form a gauge block whose height is .700 inches. One block is graduated into ten equal parts between the index graduations. By sliding this block to the right, the height of the Vernier Gauge is increased ten millionths for each graduation because of the taper. Sliding the block to the left, the height of the Vernier Gauge is decreased ten millionths of an inch for each graduation.

The Vernier Gauge has a total range of one ten thousandth of an inch plus or minus, thereby enabling dimensions to be made in increments of ten millionths above or below any dimension which can now be made with a standard set of precision gauge blocks.

For brief reference use IAVE—512.

NEW CATALOG ON ABRASIVE MILLING

Abrasive milling is the subject covered by the new streamlined "Horizontal" catalog just announced by the Andrew C. Campbell Division, American Chain & Cable Co., Inc., Bridgeport, Conn.

Each page in this catalog is a complete unit giving necessary data and specifications of the No. 302 Campbell Horizontal Wet Abrasive Cutting Machine.

A special chart on the back page outlines the standard models in the Campbell Abrasive Cutting Line.

The catalog is a handy reference book for those who want to keep posted on Abrasive Cutting developments. A copy may be had for the asking.

For brief reference use IAVE—513.

RECONDITIONING PENCIL SHARPENERS

A four-page folder on how to install cutters in the Boston Pencil Sharpeners has been prepared by the C. Howard Hunt Pen Co., Camden, N. J. Sets of cutters are available to replace worn ones, to keep your sharpeners working efficiently. This leaflet may be obtained free for the asking.

For brief reference use IAVE—514.

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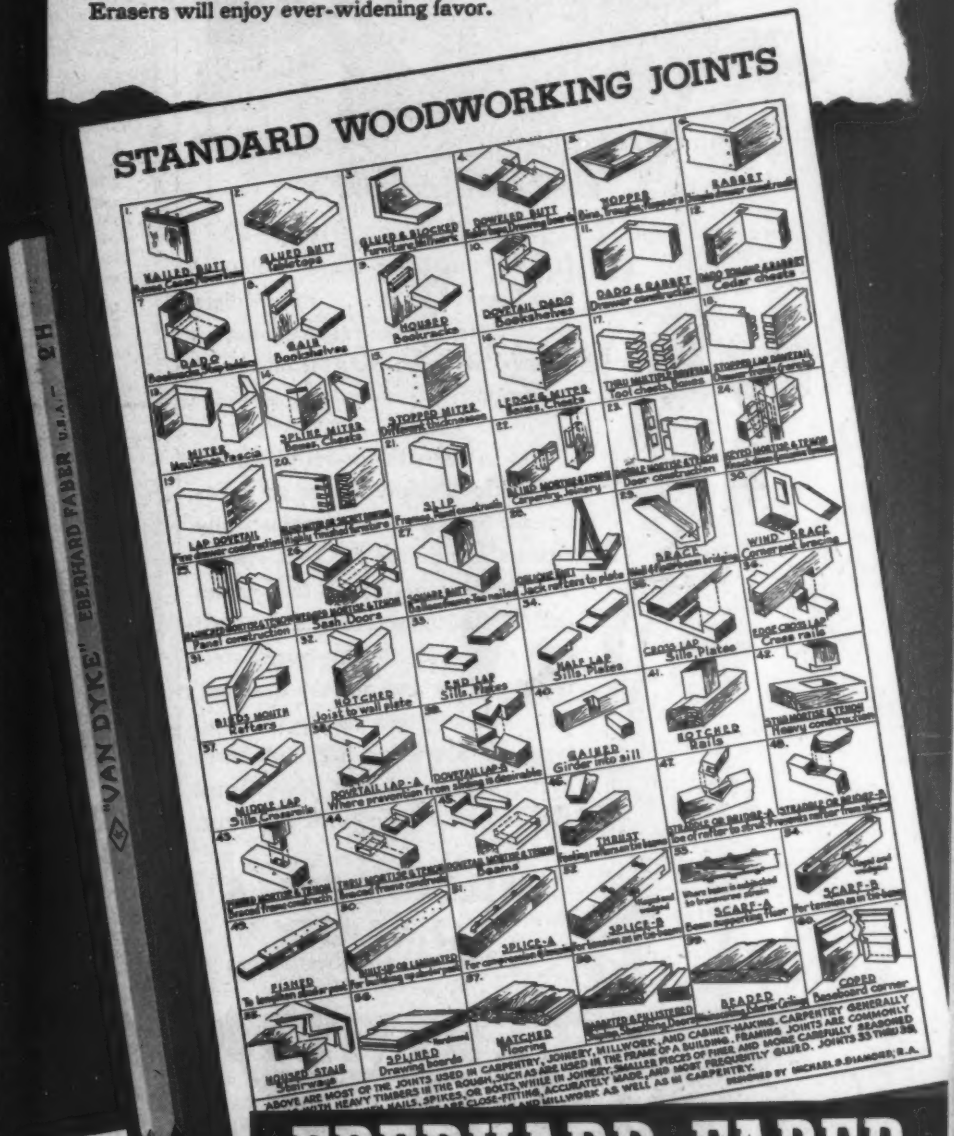
Not unselfishly, we hope, too, that MICROTOMIC VAN DYKE DRAWING PENCILS and Erasers will enjoy ever-widening favor.



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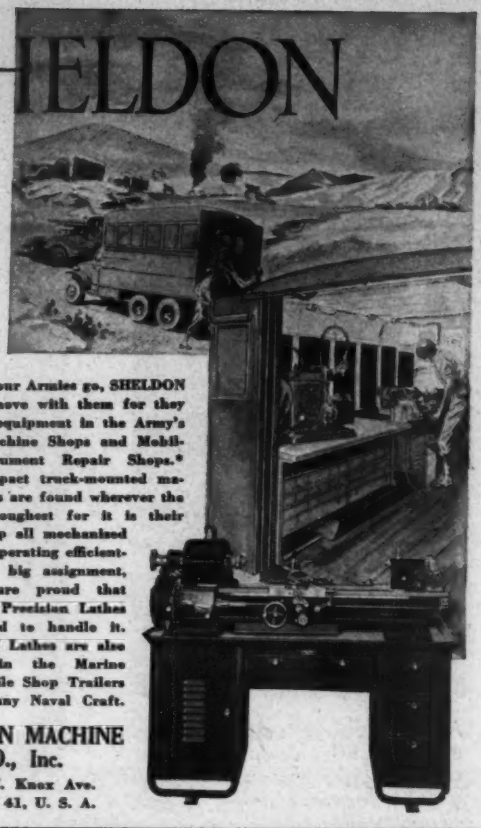

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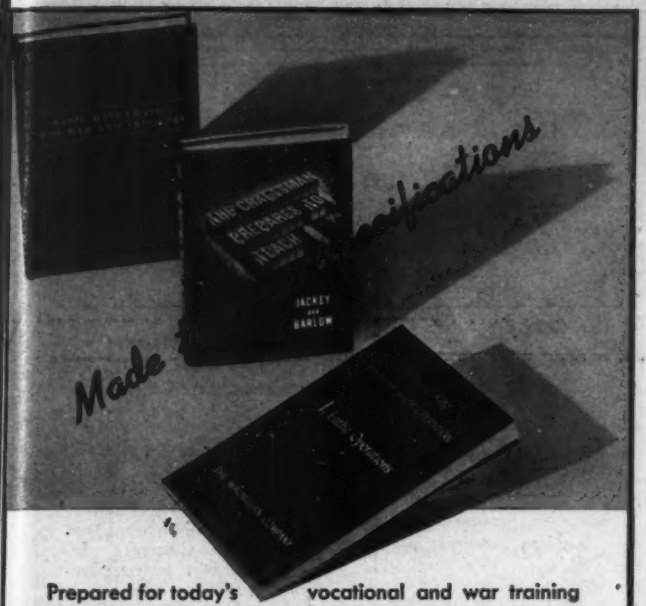

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and the just-published

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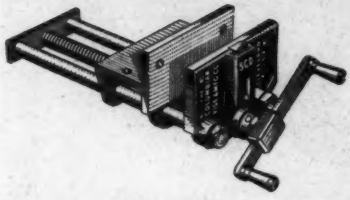

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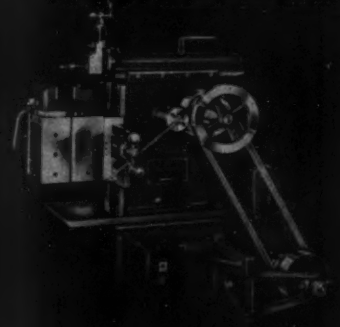

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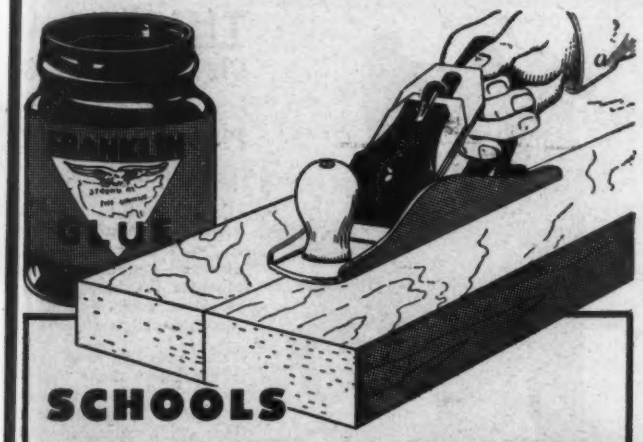

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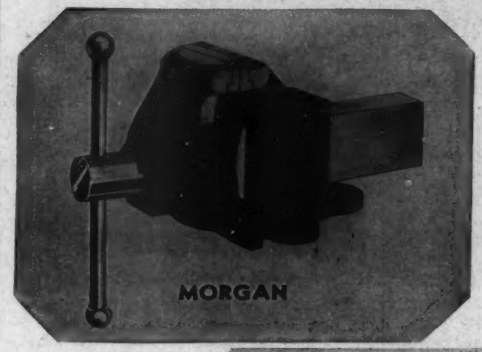

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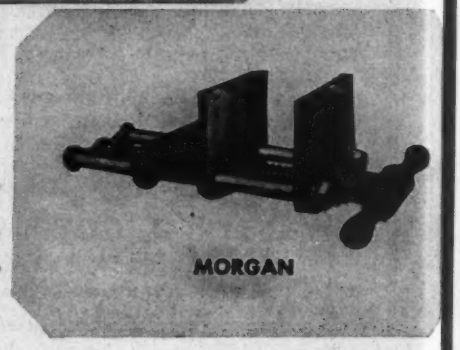

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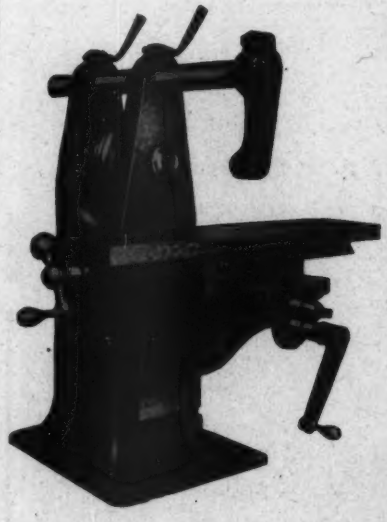

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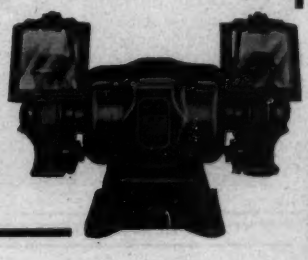

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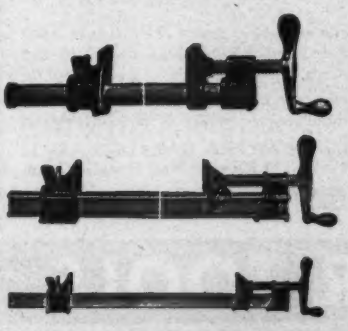

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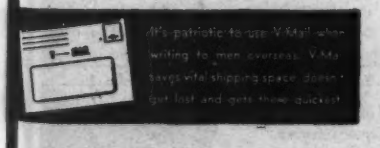

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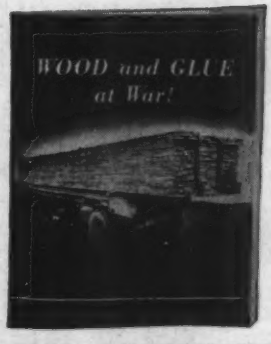

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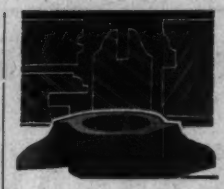

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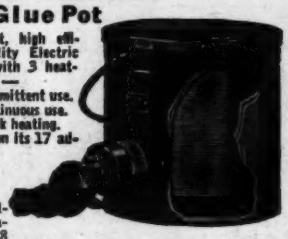
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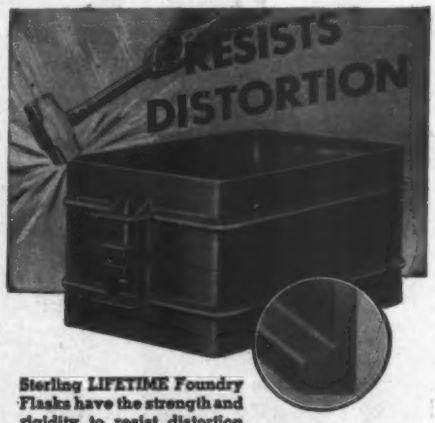

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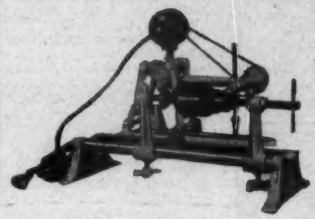

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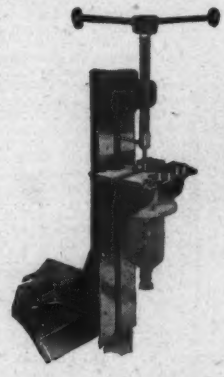

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Turning Tips for Trainees

No. 6 in a series of "Turning Tips for Trainees"
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Lots of new lathe hands figure that rough turning is a kind of hacking process that doesn't call for much brain work. It's probably true that roughing isn't as much of a trick as finishing, but there are some important do's and don'ts. Here's some dope that you will want to remember.

1 POSITION OF COMPOUND REST FOR ROUGH CUTTING

This is wrong. Slide overhangs too far to right. Might break in middle of tee slot.

This is wrong, too. Slide overhangs to left. Also could break in middle of tee slot.

This is right. When making heavy cuts, top slide should be flush with bottom slide so all metal is in compression.

2 CUTTING SPEEDS

KIND OF MATERIAL	CUTTING SPEED Ft. per Min.	DEPTH OF CUT Inch.	RATE OF FEED Per Rev.
CAST IRON	210	3/8	0.062
SEMI-STEEL	280	1/8	0.012
TOOL STEEL	140	1/2	0.020
BRONZE	425	3/16	0.024
BRASS	458	3/32	0.108
ALUMINUM ALLOY	570	1/8	0.031

When using carbide type tools, these figures are as good as any for a general guide. The rigidity of the machine and tool support, interrupted cuts, etc., will make experimentation and adjustments desirable.

3 SLOW DOWN AND FINISH SOONER . . . .

There is a tendency for many lathe operators to work their machine far below top efficiency because they fail to take a deep enough bite. Where tool failure is the limiting factor in size of roughing cut, it is usually possible to reduce the speed but increase the feed to such an extent that the amount of metal removed is greater than at a faster clip.

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